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ABSTRACT

This survey presents the highlights (not an inventory) of the environmental studies, capabilities, and instrumentalities on the Committee on Institutional Cooperation (CIC) campuses. The CIC institutions include the University of Illinois, Indiana University, University of Iowa, University of Michigan, Michigan State University, University of Minnesota, Northwestern University, Ohio State University, Purdue University, University of Wisconsin, and the University of Chicago. The survey was conducted during 1970 by a team from the University of Wisconsin by means of on-site interviews and conferences with faculty members, researchers, administrators, and students. These components of environmental studies are reviewed: university-wide committees, centers and institutes for environmental studies; interdisciplinary environmental research; university external affairs; student environmental activities; and rationale behind formation of new environmental institutes. Conclusions indicate that seven of the CIC Universities have established, or are establishing, university-wide Environmental Study Centers or Institutes, and that a variety of new environmentally-oriented courses in many disciplines are being developed. Other conclusions and recommendations are provided. Appendices include persons contacted, new courses, and student environmental organizations. (PR)

ENVIRONMENTAL STUDIES
AT THE
CIC UNIVERSITIES

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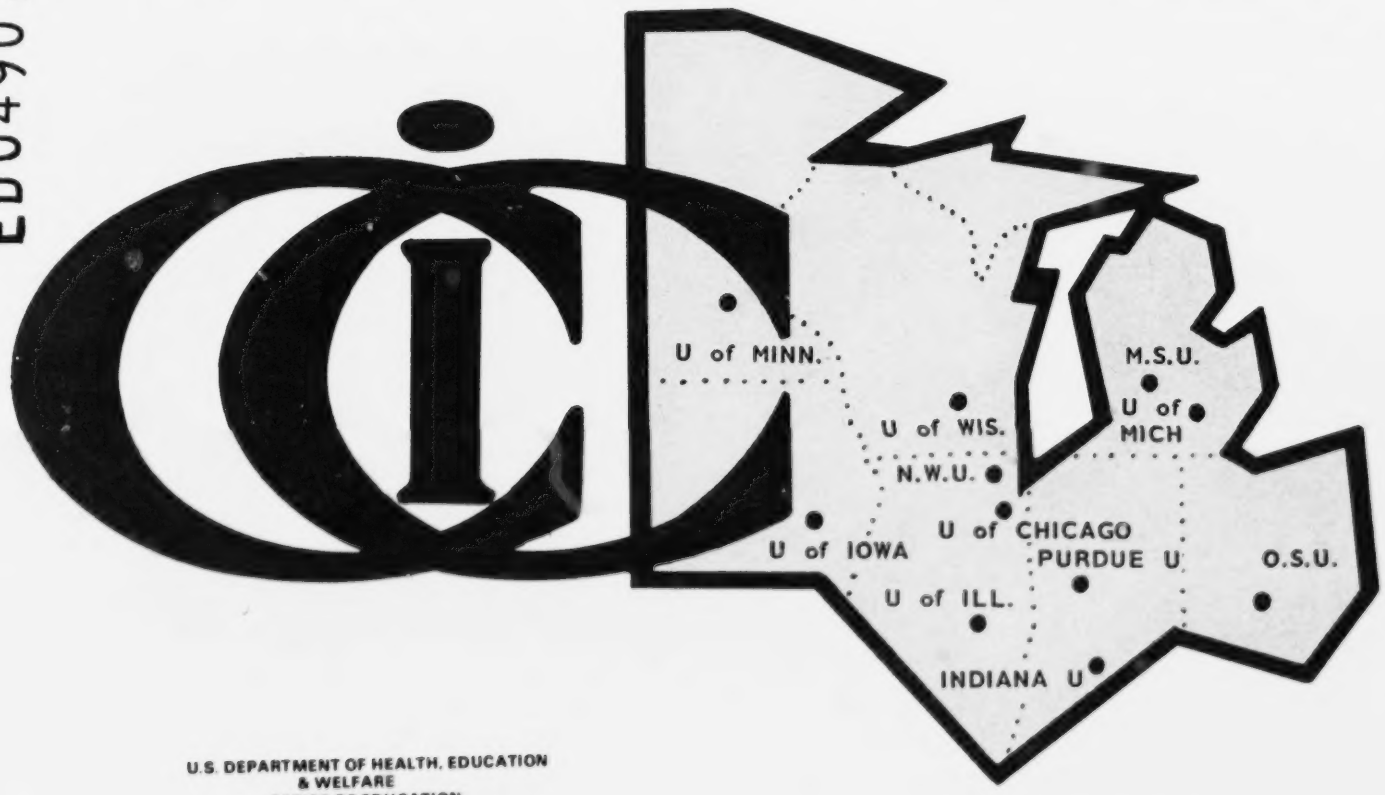

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A Survey for the Conference Group on Environmental Studies Committee on Institutional Cooperation January 1971

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ENVIRONMENTAL STUDIES AT THE CIC UNIVERSITIES--
A SURVEY

by

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January 1971

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PREFACE

This report is a survey of the highlights and not an inventory. The intent was to provide a general, quick survey which would provide a basis for other more specialized reports.

We have tried to make this report as factual as possible by use of documents and tape recordings; nevertheless, the authors apologize for the inevitable omissions which undoubtedly will occur in a report of this type.

In this survey we include only the "original" campus of each of the CIC Universities. Of course, there is a great deal of activity at the many state-system campuses such as Chicago Circle, Duluth, Gary, Green Bay, Milwaukee, and others, but this is beyond the scope of this report. Similarly, the university extension systems represent another network which is outside the scope of this report.

ACKNOWLEDGEMENTS

The authors wish to thank the members of the CIC Conference Group on Environmental Studies for their excellent cooperation in arranging the site visits which we made to each of the campuses.

In particular, we thank Ronald Wilson and Pat Logan from Michigan State University for conducting the site visit at Madison. Thomas Murray from the University of Wisconsin ably substituted on one of the site visits and made several helpful suggestions on the report. John Ross from the University of Wisconsin also suggested a number of improvements in the report. Finally, we acknowledge the helpful counsel of Charles Engman and Louie Echols from the central administration at the University of Wisconsin.

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I . INTRODUCTION

The Committee on Institutional Cooperation (CIC) was established in 1958 by the presidents of the participating universities as a means of expanding opportunities in certain highly specialized areas of instruction, research, and public service. The member institutions of the CIC are the Big Ten Universities and the University of Chicago.

Group conferences on Environmental Studies were held by the CIC on April 15 and May 21, 1970. One of the recommendations from these meetings was that a survey of Environmental Studies at all of the CIC Universities be conducted by a two-man team from one of the universities. The University of Wisconsin agreed to assume responsibility for the survey, and travel funds were provided by the CIC.

The task requested by the CIC Conference Group on Environmental Studies was to survey the environmental studies capabilities and instrumentalities on the CIC campuses. Site visits of one or two days each were conducted during the months of July, September, and early October, 1970. We relied on the CIC Conference Group representative at each of the schools for the initial contact and asked him to arrange the schedule of the visit. We requested first a round-table discussion involving ten or twelve people from various segments of the campus who were actively involved in administration, teaching, and research with respect to environmental studies. We requested to meet later in the day with a group of students. The remainder of the visit was usually spent in discussions with various individuals. We include in the report only those areas and topics which were mentioned during the site visit. The administrative and faculty personnel who were contacted during the survey are listed in Appendix I.

In order to give detached treatment to The University of Wisconsin, two representatives from Michigan State University--Professor Ronald Wilson and Mr. Pat Logan--conducted the site visit at Madison in the presence of the authors.

The nature of the survey was admittedly quite open-ended because of the rapid changes and variation in definition for environmental studies. At least the term "environmental studies" seems to prevail over the terms "environmental science," "environmental health," or "environmental management."

In an attempt to clarify the definition of "Environmental Studies," the following quote is offered from The University of Wisconsin (Madison) Faculty Document 279:

> "Perhaps one approach is to recognize that three broad postures can be identified as characterizing traditional University teaching and research. The first is the intrahuman approach, in which we study and exemplify man primarily as an isolated being; for example, the humanities. The second is the interhuman approach, in which we examine man primarily in terms of his relationships to other men; for example, the social sciences. The third is the infrahuman approach, in which we examine the natural world in all its details; for example, the physical and biological sciences, below the level of man and society.
>
> "No rigid lines, of course, separate these three postures; there have been and continue to be many intergrades of perspective. Now, however, there does seem to be emerging a fourth major posture vis-a-vis the study of man and his world. It is distinguished by its focus on the holohuman; that is, on the relationships between man (individually and collectively) and his natural and man-made environment. This is what we appear to be calling 'environmental studies.'"

Several other surveys on environmental studies about the country have been conducted. The Argonne Universities Association initiated a survey last year; however, no final report has been issued. Steinhart and Cherniack conducted a survey of six universities and issued a report for the Office of Science and Technology (Ref. 1). The Library of Congress last year conducted a mail survey, and received responses from 500 universities and colleges in the United States (Ref. 2). A listing of U. S. and foreign organizations concerned with environmental research by geographical location and field of interest was done by Mordy and Sholtup (Ref. 3). The Scientists Institute for Public Information published a workbook on environmental education with sections on student desires and university responses, including the personal philosophies of many educators, as well as descriptions of approximately 70 university programs (Ref. 4).

The efforts of the Environmental Sciences Institute in San Jose, California, and the Ecology Center in Berkeley, California, were combined

to produce a "Survey of Environmental Science Organizations in the USA." This survey is expected to be updated in July of each year and includes the following types of organizations: college and university centers, non-profit organizations, citizens' groups, Federal Government departments and agencies, professional societies and academies, publishers and journals, and science-based industries (Ref. 5).

In this report we attempt to survey the highlights of the plans and activities in Environmental Studies at the CIC Universities. No claim to completeness is made; rather the report reflects the areas which were discussed during the site visits which we made to each of the CIC Universities. Administrative efforts to form University-wide organizations for Environmental Studies are reviewed, and teaching, research and public service related to environmental areas are delineated. Our conclusions and recommendations relative to the CIC are found at the end of the report.

II. UNIVERSITY-WIDE COMMITTEES, CENTERS, AND INSTITUTES FOR ENVIRONMENTAL STUDIES

In response to faculty, student, and public interest and concern for the quality of the environment, various university administrations in the CIC have recently established new interdisciplinary committees, and in many cases university-wide institutes or centers. In this section, we review the organizational status at the time of the site visit. In the next section, we consider new developments in various schools and colleges. Some features of the new university-wide units are summarized in Table I at the end of the chapter.

It should be noted that a considerable amount of work with significance to the quality of the environment is carried on in units of less than university-wide scope. In fact, at present most such work at the CIC schools has no, or only minimal, university-wide inputs. Discussions of some of these more sharply focused interdisciplinary efforts, such as Schools of Natural Resources and Water Resources Centers, are included later in this report.

The University of Chicago has no overall coordinating committee and, as far as we know, there are no plans for a new center or institute for environmental studies. However, the Center for Urban Affairs has a coordinating committee on Environmental Studies.

The University of Illinois: On February 10, 1970, an Ad Hoc Committee on the Environmental Science Program was appointed by the Vice Chancellor for Academic Affairs and charged to consider how the University could best organize its teaching, research, and public service activities in the environmental science areas. The Committee was composed of twelve professors from across the University and two students. Their final report was submitted on July 9, 1970.

The Committee recommended that the University establish an Environmental Studies Institute. This Institute would be engaged in active research, educational and public service programs, and should be administered directly under the office of the Chancellor. The Committee felt that an Institute should be established in order to achieve appropriate staff commitment, leadership, focus, funding, intellectual environment, physical facilities, control of the curriculum, control of the reward system, and appropriate contact with society.

The Committee recommended that the Institute have its own faculty and staff, its own budget, and its own facilities. The Director would be the chief administrative officer of the Institute, and he would report directly to the office of the Chancellor. The staff of the Institute is the backbone of the organization. There would be a core of faculty who are totally committed to the mission of the Institute. The following types of faculty are suggested: 1) voluntary transfer of certain individuals currently on the faculty in other departments of the Institute on a full-time basis; 2) recruitment of highly qualified faculty for full-time appointments in the Institute; 3) joint appointments; 4) swinging appointments; 5) associate faculty; and 6) adjunct faculty. The Director of the Institute would be assisted by an executive committee. It was recommended that there also be established an intramural advisory council made up of representatives of the various colleges, state surveys, and other University units. In addition, there should be established a high level group of advisors from community, government, and industry which would constitute an extramural advisory board. There should be no departments within the Institute, but rather various task forces would constitute the basic components of the Institute. The Institute should assume responsibility for the courses and for student programs, and should serve as the administrative home for the faculty. It would have responsibility for recruitment and recommendations for promotion. Tenure would originate in the Institute.

The heart of the research program of the Institute must be interdisciplinary and multidisciplinary task forces. The task forces would provide opportunity for teams of faculty and students from a variety of disciplines to work together in the problem-solving mode on problems of social significance. Examples might include the currently emerging interdisciplinary research project on lead pollution, the whole agricultural and chemical complex, overcrowding in the cities and its psychological, social, and biological consequences, and a population control project. These task forces would assume a variety of organizational patterns in order to accommodate a variety of missions.

Eventually the Institute should teach graduate and undergraduate courses on the principles of environmental quality control, holistic concepts of environmental management, social values applicable to the environment, etc. There should be enough of these courses to permit graduate students in various academic departments to select appropriate groups of them to constitute a minor in environmental studies. An undergraduate degree program is not recommended at this time.

The public service function of the Institute will be especially important because of the social relevance of the environmental science

program. The public service function should be conducted on two levels: a high-level consultative service to federal, state, or local governmental units, and a comprehensive program of public education and advice to individuals' and citizens' groups. The entire public service function should draw heavily on and be closely coordinated with the task forces of the Institute. Staff members of the Institute should serve as points of contact with citizens, community groups, and governmental agencies.

The committee recommended that the Institute be implemented in three stages: 1) the establishment of an intramural environmental studies council which would oversee and coordinate the existing and emerging task force activities; 2) appointment of a director and establishment of an environmental studies institute of somewhat limited scope; and 3) the full recommendations of the committee.

Indiana University: At the time of the survey, there was no joint administration-faculty committee to deal with environmental studies. The feeling was that, before the formation of such a committee, it was first necessary to seek and establish the degree of interest on the part of the faculty. There are, of course, a great number of environmentally related activities at Indiana University.

University of Iowa: The responsibility for environmental studies at Iowa resides in two committees: 1) the Environmental Development Steering Committee, and 2) the Environmental Research Steering Committee. Both of these committees are chaired by the Vice President for Educational Development and Research.

The Environmental Development Steering Committee was formed early in 1970. The Committee has been considering the need for educating the masses of students, as well as specialists, in the ecological-environmental field. The Committee was urged to consider all possible options for improving the environmental sciences curriculum and is considering a basic core course in the liberal arts, as well as the problem of developing interdisciplinary courses for students who want to specialize in one particular discipline.

The Environmental Research Steering Committee met first on April 10, 1970. The role of the Committee is to promote interdisciplinary research in the environmental-ecological area. The Committee hopes to focus the research capabilities of the University on the needs of the State of Iowa.

The question of the development of a center, institute, or formal program for promoting environmental studies was considered.

The administration felt that most efforts in the environmental sciences should be conducted within existing departments and administrative frameworks. A new unit cannot be justified at this time because of lack of funds. Also, the administration felt that probably a new unit would not be welcomed at this time by the traditional departments. The bachelors of general science program can perhaps provide a vehicle for undergraduate degrees in environmental studies.

The University of Michigan--Institute for Environmental Quality: The Institute for Environmental Quality was established by the Regents in March, 1970, with funds provided by the Rockefeller Foundation. Its purpose is to provide initial support for scholars and students interested in new and interdisciplinary approaches to environmental problems. Its director is assisted by a policy committee composed of seven Vice Presidents and Deans, and by an advisory committee composed of ten faculty members and four graduate students. The director is further assisted by part-time staff assistants and released time from their teaching departments, and by research associates attached to the Institute but working in their primary units. The director of the Institute for Environmental Quality reports directly to the Vice President for Research.

In keeping with its objective of stimulating interdisciplinary teaching, training, and research on subjects of prime importance to the improvement of environmental quality, the Institute grants fellowships to highly qualified advanced students, supports establishment of new faculty positions, and provides initial funding for research projects. Ten Ph.D. candidates were awarded fellowships this year, and twenty are expected to be awarded next year. Preference is given to those students whose studies combine two or more areas of competence.

The Institute assists departments and programs to acquire new faculty members who have a strong interest in environmental problems. It provides temporary support until the positions can be funded by the University. Appointees typically embody qualifications and interests desired by two or more departments. Two new faculty members received Institute support for this year. Additional appointments will be made in the future.

The Institute provides seed money for interdisciplinary research efforts that closely relate to problems of environmental quality, and particularly projects unlikely to gain initial support from other sources. These include efforts to develop disciplinary research or to apply new techniques to environmental problems, and studies of action that could result from analysis of social, political, economic, industrial, legal, or

other conditions. The Institute is interested in encouraging broad approaches to environmental problems through support of new inter-student and inter-faculty forums and seminars. One example of this is a general seminar on environmental quality to be organized by Institute fellows. The Institute is interested in assisting both intra- and extra-mural diseemination of information bearing on environmental quality.

Michigan State University--The Center for Environmental Quality: On December 2, 1969, the administrative group approved the establishment of a Center for Environmental Quality under the responsibility of the Office of Research Development. The Center was established to more effectively assist in identifying and mobilizing MSU's resources in the pursuit of environmental quality programs. The urgency for establishing an instrument which will help identify current resources and programs, and mobilize, where appropriate, interdisciplinary interests and efforts is apparent to those engaged in environmental programs. Thus, a major function of the Center is to help the interested academic units articulate in an optimum manner the contributions and aspirations in the several areas of environmental quality.

The Center seeks to build on the existing units of the University. The role of the Center is to assess what the University should do in environmental studies, provide a means of bringing together the various disciplines required, to modernize the course content throughout the University, to develop new courses, to develop public programs, and to encourage student-faculty cooperation. The Center will assist in the development of programs, procurement of funds, and to act whenever appropriate as a recipient for funds. The main focus of the Center will be on enhancing the quality of life.

The administration of the Center for Environmental Quality is the responsibility of the Vice President for Research Development. The Center is guided by a policy and program advisory board consisting of Deans and academic research administrators, and by the Interdisciplinary Teaching and Research Committee which is composed of persons recommended by the respective Deans. The Policy and Program Advisory Board has 16 members; the Interdisciplinary Teaching and Research Committee has 27 members. Liaison between these two groups will be provided by the Assistant Vice President for Research Development who will act as chairman for the Teaching and Research Committee. The functions of the Interdisciplinary Teaching and Research Committee include a) to develop recommendations to appropriate departments and Colleges for the initiation of undergraduate and graduate curricula in environmental quality,

b) to identify existing programs in environmental quality, to facilitate their implementation, and to make recommendations for the initiation of new projects, c) to advise on establishing a system for information dissemination to faculty and students and appropriate off-campus audiences through faculty and student seminars and colloquia involving the public and appropriate use of communication media.

Four permanent committees have been established under the Interdisciplinary Teaching and Research Committee: 1) the faculty-student action committee, 2) a teaching committee, 3) a systems science committee, and 4) forensics of environmental law. The Center will have no tenured staff of its own, but rather draw on the various departments.

The University of Minnesota: An ad hoc Intercollegiate Committee on Environmental Studies was formed and asked to examine existing programs at the University of Minnesota, to explore needs, and to suggest possible new programs at the all-university level. The Committee's first act was to request a report from each college on the environmentally related programs of that college. Through these reports, the members educated themselves to each others' programs (an activity which was deemed very useful) and provided the University with a complete survey of its environmental programs.

The Committee noted a variety of administrative frameworks to meet the multidisciplinary requirements of environmental research and study. On the research side, they cited the Agricultural Experiment Station, the Water Resources Research Center, the Environmental Health Center, and the Institute of Technology Center for Studies of the Physical Environment.

The Committee recommends that a Council on Environmental Quality be organized. The Committee chose the term council because they expect that several "centers" might evolve as the Council performs its work. The Council would have a Director who reports to the central administration and would include members from all units within the University that are concerned with the natural and man-made environment. The Committee does not anticipate that the Council will supersede the established authority of any department or college in admission of students or awarding of degrees, nor would it necessarily have overall authority for approving research grants in environmental areas.

The Council should initiate or accommodate programs which are distinctly multidisciplinary and intercollegiate. The Council would supplement teaching interests and capabilities in multidisciplinary,

undergraduate, and graduate programs. The Council would fund public lectures and explore other means for public service, such as development of a work-study program involving public and private organizations and the students.

The Committee emphasized the needs that such a Council would fulfill: systematic, effective coordination of the existing resources, programs, and projects, together with new research and teaching to a) close gaps between present topics, b) develop comprehensive systems approaches, and c) explore the relation between human goals, social changes, and "environmental quality."

Northwestern University: The responsibility for environmental studies at Northwestern resides in the Council for Environmental Studies. The Council is composed of eight professors and two students. The Council was established by the Provost in April, 1970. It serves as an all-university group with the responsibility of planning the kind of program for environmental studies suitable to Northwestern along with suggestions for a permanent organization. The Council will coordinate the various groups concerned with environmental problems on the Evanston campus and the Chicago campus.

The Council is subdivided into three groups: 1) curriculum, 2) research, and 3) external affairs. Each panel is charged to make short- and long-range plans and to develop operational proposals.

Ohio State University: Early in 1969 the Dean of Mathematics and Physical Sciences formed an ad hoc faculty Committee on Environmental Sciences to suggest policies and programs for the College and for the University. The Committee felt that a carefully constructed university-wide program of instruction should be directly responsible to the Office of Academic Affairs, receive substantial support from the University, have some full-time staff, and be empowered to make joint appointments. It should have authority to offer courses and degree granting programs. In order to implement their proposals, the committee suggested further discussion with faculty, department heads, and deans, and appointment of a Program Director and skeleton staff.

As a result of the Committee on Environmental Sciences' report, the President of the University formed a university-wide task early in 1970 to review the programs at OSU and other universities and to make further recommendations. At the time of the survey, the President's task force had not released their report.

In addition, it was recently announced that The Ohio State University and Battelle Memorial Institute will jointly establish an Academy for Contemporary Problems, provide facilities, and pledge program support for a minimum of ten years at an estimated annual level of $1 million. The Academy will include a $2 million facility to be built and operated by Battelle on its property in Columbus. Full-scale occupancy is expected by 1972. The principal theme of the Academy's function would be to provide means of institutional and organizational adaption to changing social patterns; means to put knowledge into action, including transfer of knowledge from one field to another; and improvement of inter-institutional communication.

Purdue University--Institute for Environmental Health: The primary responsibility for Environmental Studies at Purdue resides in the Institute for Environmental Health. The Institute was established in 1965 to provide scientific leadership and coordinated management for an interdisciplinary research and educational program in the area of environmental concerns. It is a research and educational entity in the University comprising a group of teachers, investigators, and students from a number of disciplines. They are associated together because of a common scholarly and professional concern for the study and control of the interaction of man and his environment. Emphasis is placed on interdisciplinary approaches to environmental problems. The administrative framework of the Institute consists of a Policy Committee with general management authority, a Director of the Institute, and an Interdisciplinary and Advisory Section. The Interdisciplinary and Advisory Section is the core staff, having the major responsibility of promoting central concepts and planning, including participation in seminars, serving on interdisciplinary research and training committees, discussion and establishment of graduate students and doctoral research projects, direction of graduate and post-doctorate research, serving as members of the interdisciplinary study section. The advisory section includes people from bionucleonics, environmental engineering, animal science, pharmacology and toxicology, and physiology.

The Institute is made up of members of the present University staff--approximately 90 in number. The staff does not hold title in the Institute nor does the Institute award degrees. The staff holds title in the schools and departments with which they are affiliated. Graduate students are granted degrees by presently established schools within the University. The Institute does not have facilities of its own, but rather carries on its activities in the educational and research facilities of those departments and schools of the University from which the staff

and students are drawn. Funds are transferred to the departments. It is not intended that the Institute consolidate the total research and training effort in the area of environmental sciences. The Institute program is supplemental and additive to other activities in environmental areas.

A number of interdisciplinary and research training subcommittees made up of different individuals in different departments submit specific proposals to the Interdisciplinary and Advisory Section. The section encourages, receives, views, coordinates, and makes recommendations for activating approved projects. Approved projects are carried out under the responsibility of a principal investigator, as is currently the practice with research and educational grant funds. A newsletter is published four times a year by the Institute. Five new core courses have been established under the auspices of the Institute. Numerous interdisciplinary research projects have been initiated.

The University of Wisconsin--Institute for Environmental Studies: In May, 1969, the Committee on the Future of Man, while reporting on the "Purpose and Function of the University," asserted that the faculty can no longer afford the luxury of assuming that the future will take care of itself, and stated that:

> "The primary purpose of a university is to provide an environment in which faculty and students can discover, examine critically, preserve, and transmit the knowledge, wisdom, and values that will help insure the survival of the present and future generations with improvement in the quality of life."

Having noted the above background and noting the extensive existing faculty research and teaching in environmental studies, the Chancellor's Advisory Committee on Environmental Studies recommended in December, 1969, that the existing Institute for Environmental Studies be reorganized and staffed so that it could provide leadership and impetus to University effort in this area of public concern.

In January, 1970, the University of Wisconsin reassigned the Institute for Environmental Studies as directly responsible to the Chancellor of the Madison campus. For two years preceding, the Institute had been a research unit within the Graduate School. The Institute was administratively restructured on the basis of a series of recommendations by the Chancellor's Advisory Committee on Environmental Studies to provide improved leadership and impetus to the University's research and teaching efforts in the environmental studies area.

The Institute is responsible for developing interdisciplinary environmental research at the undergraudate, graduate, and faculty levels; undergraduate and graduate courses and degree programs; and improved communication among groups involved in environmental research, training, and extension programs. New, cross-disciplinary courses dealing with the man-environment system and curricula in environmental studies are currently being developed.

The Director of the Institute, appointed by the Chancellor and reporting to him, is responsible for executing the functions of the Institute. The Institute is tied into the existing structure of the University by three groups--a Board of Directors, an Advisory Committee, and an Executive Committee. The Board of Directors is composed of academic Deans, designated by the Chancellor, who review the policies and practices of the Institute. The Advisory Committee, also appointed by the Chancellor, is composed of faculty members representing the biological, physical, and social sciences and the humanities.

Seven tenured faculty members, elected from the Advisory Committee, form the Executive Committee, which is chaired by the Director of the Institute. This committee "directs" policy and budget; advises on administrative appointments; reviews overall programs; reviews and recommends faculty salaries and promotions where pertinent; and assists and advises the Director in application of funds.

The Institute currently includes the Marine Studies Center, the Center for Climatic Research, Remote Sensing Study Group, and the Lake Wingra Ecological System Study Group of the International Biological Program. By serving as the administrative organization for such groups, the Institute hopes to deal more effectively with the intricate interrelationships among features of the physical and biological environment and their social, economic, and political consequences.

TABLE I
UNIVERSITY-WIDE UNITS FOR ENVIRONMENTAL STUDIES

	U. of Chicago	U. of Illinois	Indiana U.	U. of Iowa	U. of Michigan	Michigan State U.	U. of Minnesota	Northwestern U.	Ohio State U.	Purdue U.	U. of Wisconsin
Faculty Committees	X	X	X	X	X	X	X	X	X	X	X
Coordinating Committee		X					X	X			
Institute or Center Recommended		X					X		X	X	X
Institute or Center Established					X	X				X	X
Funds Research					X	X				X	X
Funds Students					X	X				X	X
Offers Own Courses											X
Offers Joint Courses						X				X	X
Has Joint Appointments					X	X					X
Presently Awards Degrees											

III. ENVIRONMENTAL STUDIES CURRICULUM DEVELOPMENT

Since Environmental Studies are interdisciplinary by nature, we consider here only those courses which are designed for students from a variety of backgrounds. During the site visits we were presented with a wide variety of individual courses and also several consolidated efforts at curriculum development. As mentioned in the preface, this report is intended only to illustrate programs that are developing rather than providing a comprehensive summary of them. In this section, our illustrations consist of, first, three innovative attempts at interdisciplinary curriculum development and, second, a discussion of recent developments in ecology, engineering, environmental design, and natural resources at several schools. Individual courses which were discussed during the site visits are listed in Appendix B.

A. Innovative and Integrative Approaches

The University of Michigan, College of Literature, Science and the Arts, has initiated a Bachelor's Degree Program in which, in addition to concentrating in one of the traditional disciplines, the student has parallel training in Environmental Sciences, with maximum opportunity to explore ways in which his chosen discipline might contribute to the solution of programs in environmental quality. The aim of the program is to meet the responsibility for the education of the informed citizen, for the students who will find places of responsibility and decision-making in the public and private sectors, and for students who intend to go on to graduate or professional work in a particular discipline or in environmental studies.

The basic curricula model is as follows:

1. The student will satisfy the usual requirements for graduation with a B.A. including language, English, and satisfaction of concentration requirements in some field.

2. A special cognate program in Environmental Sciences is elected and paralleled with the concentration.

3. Concentration programs for students in the joint program will, wherever possible, be tailored for maximum congruence with the environmental science concern.

4. The student will graduate with the joint degree B.A. in (discipline) and Environmental Studies. Thus, a typical degree might be: B.A. in Economics and Environmental Studies, or B.A. in Geography and Environmental Studies.

The Environmental Sciences Cognate Program includes two basic introductory courses at the freshman level, a sophomore-junior pro-seminar series entitled "Problems in Environmental Quality," and a senior "Practicum" in Environmental Science.

The freshman course, which is starting this fall, is designed as an introduction to the complexities of environmental problems. It attempts to survey the physical, biological and human systems which interact to cause the problems and which must be considered when solutions are designed. Major topics include the earth, the biosphere, man's nature, man' s systems and their development, the structure of contemporary societies, and contemporary problems. The first term has a natural science orientation, while the second term will concentrate upon legal, political, economic, and social factors bearing upon the environment and its protection. Grading in the course will be pass-fail based to a large extent on reading logs. The course will be taught by faculty from eight or ten different departments, and in order to provide continuity, it is suggested that all of the faculty attend all of the lectures.

In the sophomore and junior years, students electing this program will be required to take one pro-seminar each term on problems in environmental quality. A problem-oriented and problem-solving approach will be used in conjunction with special projects and field experiences. A two-term survey of environmental studies will be required in the senior year in which advanced approaches to problems be taken up and where the student would have an opportunity to integrate the point of view gained from his concentration program with one or more aspects of environmental studies by means of individual or class projects.

In order to implement this degree program, a steering committee on environmental studies from the College has been established. Ten departments within the College are participating. The response by students and faculty has been very favorable, and the committee hopes that this will be a first step toward that "new humanism"--a contemporary concern with enduring values that dictate the relation of man to man and the role of man in nature.

At Michigan State University a Systems Science Program has evolved which includes faculty from Electrical Engineering, Chemical Engineering, Zoology, and others. The systems theory of electrical engineering, the physical principles and process controls of chemical engineering and the biological relationships are being integrated into a sequence of three courses which forms the core of a systems science program.

The sequence focuses on a systematic introduction to a science and technology for 1) the technical design and management of eco-structures of major portions of the natural environment, and 2) a design of the basic technical and spatial features of the industrial, agricultural and urban complex of a given geographic region as an integral part of the ecostructure. The courses will present basic concepts using, as examples, specific subsystems of immediate concern in agriculture and industrial development and in human waste problems, as viewed in perspective with the overall problem.

The methodology for the definition and characterization of basic components of the structure will be developed. This methodology is built upon the physical and biological laws of behavior and upon the applied mathematics, statistics, modeling, simulation, control, and information processing concepts of modern systems theory. The courses will deal with the necessary extension of the theoretical concepts and model structures required to include socio-economic and political factors that are critical to the development of more effective planning and management procedures. The sequence of courses will include the broad topics of man and his environment, the biological subsystem, the physical subsystem, the economic subsystem, mathematical representation of system structures, response characteristics as a function of system structures, and control of energy processes.

A comprehensive solution to the total environmental problem is a long-term effort requiring the coordinated efforts of virtually all of the disciplines in the physical, biological, economic, and social sciences. System science concepts provide a framework for structuring models of the total process around which coordinated programs of interdisciplinary research can be organized. Such models expressed in both conceptual and analytical terms form the foundations for the technical design and social management of environmental processes.

The University of Wisconsin's Institute for Environmental Studies is offering an introductory freshman course entitled "Forum on the Environment." In June, 1970, 14 individuals representing

every level of the University hierarchy from full professor to incoming freshman committed their summer to a development of the course. Funds for this venture were supplied by the U. S. Office of Education.

The study group started from the observation that previous educational efforts in conservation and ecology have permitted our present environmental difficulties to develop and persist. New experiments in education are thus needed. The original hypothesis was that students and faculty could work together in designing an academic format and, more importantly, that both perspectives are essential to develop an educational experience which will provide optimal learning opportunities.

"Forum on the Environment" attempts to provide a setting in which the students and teachers will be parts of a total community. Equal importance is placed on the contributions of the individual student and on those of the instructor. Teachers will also be learners as will the student also be a teacher. If the course is successful, it will serve as a beginning in a process of developing a society where people are capable of perceiving their environment and their relation to it.

The format of the course consists of two periods of lecture and three periods of small discussion groups per week. The purpose of the lectures (or non-lectures in the form of multimedia shows, film festivals, debates, etc.) is not to give the student information for which he will be held responsible on an exam. Instead, the purpose is to provide a common experience to all participants that can be used to facilitate the individual sections, while exposing students and faculty to information, concepts, and opinions about environmental problems and their solutions. The discussion sections are the main focus of the course. These discussion sections will hopefully develop into small educational communities. While the sections may go in slightly different directions, the content will consist of man's social, political, cultural, and ecological environments.

Because the course is conducted without formal step-by-step syllabi, the reading lists play an especially important role in the course and provide some common experience for discussions. The reading list was developed by the summer study group and includes two required books. In addition, each section should select four to six books which the section agrees they will read in common. Students are urged to read an additional four or five books from the reading list to complete their reading for the course. As the discussion sections progress, each student will focus on an independent project, either individually or with other students.

B. Environmental Courses in Schools and Colleges

In addition to the three programs discussed above, a large number of environmentally-oriented courses are now being offered, many of them new in the last few years. New courses representing a variety of disciplines, which were described to us during the site visits, are listed in Appendix B.

A number of documents describing changes in departmental offerings were presented to us, and below we try to show some of these changes by discussing recent developments in Ecology, Engineering, Fine Arts, and Natural Resources. Many other important developments are seemingly occurring in Law, Public Health, Urban and Regional Planning, Architecture and Design, and Business Administration, to name a few.

Schools and colleges at the CIC Universities, which are deemed to have an input to Environmental Studies, are indicated in Table II. As noted before, only the "original" campus of each CIC University is considered here. Urban and Regional Planning and Architecture and Design are not shown because they are found in different units at different universities. The differences in character of the various universities, and thus differences in perspective of environmental studies are reflected to a certain extent by the types of academic units on each campus.

This section is, of course, incomplete but it reflects where we were led during the site visits and illustrates the kind of things being done.

Ecology

At the University of Michigan, there is an interdepartmental doctoral degree program in Ecology for students who wish to undertake interdisciplinary studies in this field that are of greater breadth than can be accommodated by programs within a single unit of the University.

This program is intended to equip students from diverse fields of science, who wish to concentrate in the field of environmental biology, with the conceptual knowledge and analytical tools needed to deal with the relations between ecological systems and their environment. The program is designed for students with a background in one field who wish to apply this knowledge to ecological research in another. Ecology may also be elected as the major field of specialization by students taking degrees in the Departments of Botany, Resource Planning and Conservation, Forestry, Wildlife and Fisheries, and Zoology. Students planning to study in one of these departments should apply directly to the appropriate

department rather than to the Interdepartmental Program in Ecology.

At the University of Illinois, Environmental Biology is an interdepartmental area of specialization coordinated under the Biology program and supervised by an Executive Committee. The program is staffed by scientists from the Departments of Agronomy, Botany, Entomology, Forestry, Microbiology, Physiology, Sanitary Engineering, Veterinary Medicine, Zoology, and the Natural History Survey. Areas of specialization under Environmental Biology will normally include: animal, plant, and human ecology, physiological and population ecology, population genetics and systematic biology, limnology, ethology, zoonoses, and applied ecology. Programs of study and doctoral research are adjusted to individual interests, in consultation with the student's advisor and with the approval of the Executive Committee of the Environmental Biology Program.

Engineering

For many years, engineering schools have struggled with the problem of how to mix "liberal arts" in with the engineering curriculum. Similarly, the proper perspective for coping with environmental problems requires interaction with disciplines outside of engineering. One trend which we noticed was a number of new courses which are taught jointly with engineering and one or more other departments. Six courses of this type which are presently being taught are reviewed below.

1. Man's Impact on the Environment (Engineering/Geography, Michigan). A critical examination of the consequences of technological action in our lives including a look at some of the benefits and harmful effects of technology; man's impact on the atmosphere, the hydrosphere, the geosphere, the plant biosphere, and the animal biosphere; technical and nontechnical solutions to adverse environmental impacts.

2. Political Factors in Environmental Engineering and Water Resources (Engineering/Political Science, Michigan). An introduction to political processes, organizations, theories, and analysis in the United States; mathematical simulation of political processes; application to water services and multiple purpose river basin development.

3. Air Pollution Seminar (Engineering/Chemistry/Law/Economics/Public Health/Biology/Urban Planning, Illinois). Many viewpoints including historical, medical, engineering, biological, economic, law, and land use aspects of air pollution. It is cross

listed by the seven departments and involves about 16 faculty members who present seminars for graduate students. Topics vary from year to year.

4. Design and Management of Environmental System I, II, III (Engineering/Biology, Michigan State). Systematic introduction to the technical design and management of ecostructures of major portions of the natural environment; design of the basic technical and spatial features of the industrial, agricultural, and urban complex of a given geographic region as an integral part of the ecostructure; a methodology for the definition and characterization of basic components of the ecostructure using physical and biological laws, and applied mathematics, statistics, modeling, simulation, control, and information processing concepts of modern systems theory; extension of theoretical concepts to include socio-economic and political factors that are critical to the development of more effective planning and management procedures.

5. Technology and Society (Engineering/Humanities, Iowa). For liberal arts students and engineering students--to maximize awareness of the relation between technology and a habitable human environment; to implant (especially in future engineers) a desire for measuring projected consequences of technological innovation against human values, and to engender (especially in liberal arts majors) an appreciation of the actual forces underlying technological changes in the environment. The students will investigate four case studies of highly specified and tangible instances of a technical solution whose consequences were imperfectly foreseen.

6. Ecology, Technology, and Society (Engineering/Social Science, Minnesota). A balanced, integrated perspective of major problems and approaches to solutions of problems related to the interaction between man, technology, and nature; topics include facts and values related to air and water pollution, solid waste and recycling, population growth and control, resource limitations, the arms race, governmental organization, and value systems of groups and individuals; exposure and interchange with a variety of specialists for student orientation and to point towards the need for interdisciplinary approaches to present-day problems.

At the B. S. level, the trend seems to be to enrich the present offerings with deeper environmental concern and selected new courses, although starting in the Fall of 1970, Purdue is offering an Environmental Engineering degree program under the Interdisciplinary Engineering Division.

At the Master's degree level, engineers at a number of schools now have available a selection of programs which combine colleagues from other disciplines. Any well-trained engineer may elect a one- to two-year program in Water Resources, Air Resources, Solid Waste Management, Environmental Health Engineering, or Urban Systems Engineering, for example. Typically, one might find some students from Geology, Botany, Zoology, Meteorology, or Biochemistry in these programs, and some of their time would be spent studying Law, Economics, Public Health, and Urban and Regional Planning.

Fine Arts

The College of Fine Arts at the University of Illinois presently includes the performing arts, the visual arts, and the applied arts. A committee concerned with the environment has proposed to regroup the existing environmental design fields into a separate administrative unit in order to respond more effectively to environmental and urban concerns. The committee took note of the pending interest in creation of a separate college of urban studies at Chicago Circle. The committee also took note of the proposal for a school of natural resources management as well as the moves toward a graduate program in environmental sciences and for an institute for environmental studies at Illinois. Nevertheless, the committee recommends establishment of a new environmental design college on the Champaign-Urbana campus. The new college should include as a minimum the following units: Department of Architecture; Department of Landscape Architecture; Department of Urban and Regional Planning; Small Homes Council-Building Research Council; a Behavioral Science unit. The committee recommends creation of a new Behavioral Science interdisciplinary unit central to the entire Environmental Design College program. The precise role of this central unit would evolve as the college develops. The staff of the Behavioral Science group should include psychologists, sociologists, economists and political scientists, as well as other specialists. Each member of the staff would have an appointment in some campus department. Within the Department of Art, the divisions of Industrial Design and Graphic Design might become appropriate ones for inclusion within the Environmental Design field. The new college should consider the possibility of offering general courses in environmental design appreciation on an all-campus basis. The development of an Urban Affairs program at the undergraduate level warrants further exploration.

Natural Resources

At the University of Michigan, all existing programs of the SNR will be appraised and ranked on a priority basis along with potential programs by the end of the Fall Term 1970. During the early months of 1971,

reallocation of dollar and faculty resources to a newly defined set of programs will begin. Changes in administrative structure and important new curricula with appropriate new courses will be opened in the Fall of 1971.

These changes which have been recommended reflect an important philosophical shift among students and faculty away from the objective of managing natural resources for their own sake (preservation and production) and towards the objective of managing resources for the good of society.

The great awakening of public and student interest in environmental problems, precipitated in large part by the environmental teach-ins of early 1970, is very evident at the University of Michigan, and it seems fair to say that much of this excitement impinges on the School of Natural Resources.

Areas of specialization presently include Forestry (Forest Biology, Remote Sensing, Outdoor Recreation, Forest Management and Economics) Landscape Architecture, Resource Planning and Conservation (Environmental Education, Ecology, Resource Management and Economics, Resource Policy), Wildlife and Fisheries (Wildlife Management, Naturalist Program, Fishery Development).

A newly established Master's degree in Ecology of Natural Resources is now offered on an interdepartmental basis within SNR. The program will integrate more closely the plant, animal, and related human aspects of ecological training. Course work consists of (1) distribution requirements in systems ecology, animal ecology, terrestrial ecology, and aquatic ecology, and (2) a series course in one of the above areas.

At Michigan State University, Natural Resources is a part of the College of Agriculture and Natural Resources. Degree programs include Resource Development, Parks and Recreation Resources, Water Resources, and Community Resource Development, as well as Fisheries and Wildlife, and Forestry. The academic staff in these programs represents a wide variety of backgrounds including law and social science.

The School of Natural Resources at Ohio State University released in September 1970 a task force report on long range plans and needs for the state. The task force consisted of four subcommittees: land and water use, recreation and tourism, fish and wildlife, and forest production and products. Each subcommittee has described characteristics, problems and needs of its specific natural resources in Ohio, with reference to the influence of the national and international situation where

relevant. The report sees increased importance for the existing natural resource fields due to increasing population, increasing leisure time, and decreasing resources.

The Ohio State University Board of Trustees approved in February 1968 the creation of a School of Natural Resources in the College of Agriculture and Home Economics. The School is guided by a broad-based advisory committee and is intended to have an intercollege orientation. Students desiring to major in Park and Outdoor Recreation, Forestry, Fish and Wildlife, Conservation, or Resource Development obtain a B. S. in Agriculture at present. A variety of graduate programs are offered.

An undergraduate curriculum option in Natural Resources was developed within the College of Agricultural and Life Sciences at the University of Wisconsin in 1966, leading to the degree of Bachelor of Science in Natural Resources. The new School of Natural Resources (in the College of Agricultural and Life Sciences), which includes three departments: Forestry, Landscape Architecture, and Wildlife Ecology, has also five centers for research, training and extension. The Natural Resource curriculum option provides a broad background in resources, environmental sciences, social sciences, and humanities with a concentration in a career field. Graduate degrees are offered in a variety of fields.

TABLE II

ACADEMIC PROFILE OF CIC INSTITUTIONS
(WITH INPUT TO ENVIRONMENTAL STUDIES)

(Schools and Colleges)	U. of Chicago	U. of Illinois	Indiana U.	U. of Iowa	U. of Michigan	Michigan State U.	U. of Minnesota	Northwestern U.	Ohio State U.	Purdue U.	U. of Wisconsin
Agriculture		X				X	X		X	X	X
Business Administration	X	X	X	X	X	X	X	X	X		X
Engineering		X		X	X	X	X	X	X	X	X
Law	X	X	X	X	X		X	X	X		X
L., S., A.	X	X	X	X	X	X	X	X	X	X	X
Medicine	X	X	X	X	X	X	X	X	X		X
Natural Resources					X	X			X		X
Pharmacy	X	X		X	X		X		X	X	X
Public Health					X		X				

IV. INTERDISCIPLINARY ENVIRONMENTAL RESEARCH

This section is divided into A) Common Research Efforts--Water Resources Centers, Agricultural Research, Remote Sensing, and Sea Grant Programs, and B) Research Activities Listed by Universities. Again, only interdisciplinary research efforts are mentioned and no claim to completeness is made; rather, this is a partial sampling of environmentally-oriented research in the CIC.

A. Common Research Efforts

1. Water Resources Centers (Ref. 6)

Water resources centers exist at the Universities of Illinois, Indiana, Michigan, Michigan State, Minnesota, Ohio State, Purdue, and Wisconsin.

The Water Resources Center of the University of Illinois was established as part of the graduate college by the Board of Trustees in 1963. Following the enactment of the Water Resources Act of 1964, the Center was designated as the Water Resources Research Institute for Illinois by the Governor. The Center now administers Title I of the Act in Illinois as well as a state-supported program of water resources research and education. The Center's primary responsibility is the sponsorship and administration of water resources research.

The Water Resources Research Center was established at Indiana University in 1963 with federal support. The Center has completed a number of studies dealing with surface mining hydrology and thermal pollution. The Center has also worked with the aquatic research unit of the Zoology Department.

The Board of Regents of the University of Michigan established a Great Lakes Research Institute in 1945. Its objectives were stimulation, promotion, and coordination of research on the Great Lakes, as well as the implementation of the University's relevant teaching and research programs. In 1960, the Institute was organized as the Great Lakes Research Division of the Institute of Science and Technology at the University of Michigan.

The Board of Trustees of Michigan State University established the Institute for Water Research in 1961. As a result of the Water Resources Research Act, the mission of the Institute broadened to include funding at other universities as part of the water research program. Activities of the Institute include the funding of research in engineering, economics, biology, sociology, agriculture, and systems analyses, as related to water resources.

The Water Resources Research Center at the University of Minnesota has responsibility for unifying and stimulating University water resources research through the administration of funds associated with the Federal Water Resources Research Act of 1964 and made available by other sources; coordinating University Research with programs of local, state, and federal agencies and private organizations throughout the state; and assisting in training additional scientists for work in the field of water resources through research. The Center plans and arranges for divisions of the University to conduct competent research of either a basic or practical nature, or both, in relation to water resources. An average of 14 research projects have been in progress during each of fiscal years 1966-1969. Most research projects are concerned with the physical and biological aspects of the water cycle, water quantity management and control, and water quality management and protection. Two research projects are concerned with the social-economic aspects of water resources planning.

The Water Resources Center is affiliated with the Engineering Experiment Station at Ohio State University.

At Purdue University the Water Resources Research Center was established as part of the Natural Resources Institute in 1964. This was the first constituent center within the Institute and was established to fulfill the requirements imposed by the Water Resources Research Act of 1964. The Center is composed of University staff members and graduate students working with, and interested in, water resources research and teaching.

At the University of Wisconsin the Water Resources Center is an organizational unit which coordinates and administers research funds provided under the Water Resources Research Act of 1964. The Center coordinates projects at the Madison, Milwaukee, and Green Bay campuses, as well as at the Oshkosh, Whitewater, and Superior campuses of Wisconsin State University, and at Marquette University. The Center has been designated by the Office of Water Resources Research as the "center of competence" for selecting, abstracting, and indexing pertinent literature in the area of eutrophication.

2. Agricultural Research

In the CIC the Universities of Illinois, Michigan State, Minnesota, Ohio State, Purdue, and Wisconsin conduct agricultural research. As a result of the Hatch Act of 1887, each of these schools has an Agricultural Experiment Station which administers the research.

Federal law requires that 25% of the Hatch funds be spent on regional research. The CIC Universities are in the North Central Region which include also Missouri, Kansas, Nebraska, South Dakota, North Dakota, and Alaska. The North Central land grant universities have agreed in principle to the "center of excellence" concept for the regional funds. Eventually, each university would be the center of excellence for one particular topic. To date, Michigan State University has chosen environmental quality, the University of Minnesota has natural resources, and the University of Nebraska has human nutrition. The potential of this concept is apparently yet to be realized.

The Cooperative Extension Service is another important arm of the agricultural land grant universities. Brought into being by the Federal Smith-Lever Act of 1914, the Extension Service puts the research knowledge to work for and through the people. With agents in every county, the Extension Service provides the human resources in the agricultural and pre-urban areas of the region.

University of Illinois: The state and federal governments have urged action programs. Cooperative extension service activities make the whole operation very close to the people. Thus, a comprehensive long-range plan has been prepared by the College of Agriculture to better meet the needs of the state. The basic concern is reclaiming and maintaining an environment that will insure clean air, pure water, and productive soil, yet still provide the basic food and fiber requirements.

New and expanded programs in the following areas have been detailed:

1. Disposal or utilization of organic wastes
   a. Animal wastes
   b. Plant residues
   c. Food-processing wastes
   d. Municipal-industrial sewage wastes
2. Pesticides and pest control systems

3. Plant nutrients as water pollutants
4. Erosion and sedimentation
5. Decision-making processes related to environmental quality
6. Human interaction with the physical environment

In order to more efficiently implement these areas, an Agricultural Council on Environmental Quality was formed and subdivided into eight task forces representing faculty in ten departments in Agriculture and various other related departments. When a particular state problem arises (such as nitrates in ground water), the Council directs the University effort. Some of these programs are coordinated with University-wide unified programs (as requested by the central administration). As the University Institute for Environmental Studies is formed, some of the unified programs may be run in that organization. Examples include low income housing, solid waste, human development, and population dispersal and rural development.

The President of the United States has established a Rural Development Council and as a consequence, there has been set up in every state the Rural Resource Development Group headed by the Director of Agricultural Extension in every state. The Group is trying to bring together all units in the state which bear on the problem to coordinate research. Several million dollars are provided each year to the 50 Agricultural Experiment Stations for this purpose.

The Agricultural Experiment Station at Michigan State University is administered by the College of Agriculture and Natural Resources but functions also in the Colleges of Natural Science, Veterinary Medicine, Home Economics, and Social Science. The Station has a staff of 280 academic persons and extensive land holdings. The Station works closely with the Cooperative Extension Service at MSU which has 400 county agents in the field. Included in the multitude of research activities, the Soil Conservation Program and the Institute of Nutrition are noteworthy.

State funds provide $300,000 per year for soil conservation, and federal funds for water shed problems are provided for county programs. The Nutrition Program is operated at roughly $1 million per year federal funds. The county agents get involved in nutrition, housing, community relationships, youth programs, and adult education. The program is primarily in urban areas and pre-urban areas. The School of Human Ecology (formerly the School of Home Economics) has a strong input, and this is an area in which the Medical School will contribute.

Since its organization over 80 years ago, the University of Minnesota Agricultural Experiment Station has served as the organizer and manager of agricultural research. The current operating budget is $9 million of which 60% are state funds. Considerable emphasis is being directed towards four program areas:

1. Resource conservation and use
2. Protection and efficient production of forests, crops, and livestock
3. Consumer health, nutrition, and well-being
4. Product development and quality--food and fiber

The Ohio Agricultural Research and Development Center at Ohio State University is currently involved in many pollution-related studies by staff members from Entomology, Agronomy, Zoology, Botany, Plant Pathology, and Animal Sciences. High priorities include animal wastes, strip mine pollution, soil erosion, infectious agents, pesticides and chemicals in agricultural wastes.

The College of Agriculture and Life Sciences at the University of Wisconsin is involved in agricultural pollution control, soil erosion, effects of agricultural chemicals, biological pest control, disposal of food processing wastes, and rural population movement, for example.

3. Remote Sensing

The University of Michigan and Michigan State University have jointly established a Remote Sensing Committee. University of Michigan has strength in infrared sensing and forestry, while Michigan State has strength in the agricultural-ecological areas. Through remote sensing the groups hope to establish the conditions of lakes, plants, and crops, and to study the coupling between urban-industrial areas and the surrounding agricultural land in order to learn how to make them compatible.

The University of Michigan's Willow Run Laboratories of the Institute of Science and Technology have had strong research programs in radar and infrared technology. Upon declassification of this information by the Federal Government, the University established in 1968 the TERRA(Training for Environmental Resources Remote Sensing Applications) Program under the direction of a coordinating committee from the School of Natural Resources, the College of Literature, Sciences and the Arts, the College of Engineering, and the Institute of Science and Technology. Natural Resources, Electrical Engineering, and Geology each offer four separate courses in this program which lead to M.S. and Ph.D. degrees in remote sensing.

Purdue University has a remote sensing research group involving about 80 people in the fields of Forestry, Geology, Soil Science, and Civil Engineering. The laboratory, which has NASA support, is at McClure Research Park. The group is concerned with resources and pollution.

The University of Wisconsin's program is concentrating on developing remote sensing methods for detecting and monitoring physical, chemical, and biological pollutants in water and the application of these methods to effective planning and control of water quality. Laboratory and field work is conducted under a NASA grant by an interdisciplinary group with the primary responsibility residing in Civil Engineering.

4. Sea Grant

In 1968 six universities in the United States were granted institutional support under the National Sea Grant University Program administered by the National Science Foundation. In the CIC the University of Michigan and the University of Wisconsin have sea grant programs.

The sea grant concept calls on universities to mobilize and apply their scientific and educational talents to pressing marine resource and engineering problems. The Great Lakes and ocean resources provide food, minerals, chemicals, water, a place to dispose of wastes, transportation, and recreation. As these uses are intensified, political, economic, legal, and cultural, as well as technical problems, arise. The Sea Grant Program is designed to identify, examine critically, and seek solutions to these problems.

The fundamental objective of the University of Michigan's Sea Grant Program is to bring together different scientific disciplines and pool their knowledge in order to provide a foundation for intelligent management and development of the water resources of the Great Lakes. For the next three years, the Grand Traverse Bay area will be studied intensively. This bay was selected because it is a reasonably complete model within the Great Lakes ecosystem.

At the University of Wisconsin research is being conducted on the total aquatic-coastal environment of Green Bay of Lake Michigan including the physical, biological, and chemical interactions to study pollution, eutrophication, pesticide effects, growth patterns, etc. Other programs include ways to process trash fish as food, effect of exotic fish in the Great Lakes, effects of nuclear power plants on the lakes, and lake bottom mineral deposits. The all-University program includes the campuses of Madison, Milwaukee, Green Bay, and

University Extension. In addition, cooperating laboratories include the Center for Great Lakes Studies at Milwaukee, Marine Studies Center, Water Chemistry Laboratory, Limnology Laboratory, and the Hydraulics Laboratory.

5. Other Research

Most of the CIC Universities have a Center for Urban Affairs and much of their work can focus on environmental problems; we do not discuss this here. Similarly, medical research is an important link in the environmental web which is beyond this report. Population Research Centers such as the ones at the Universities of Michigan and Chicago should also be noted.

B. Research Activities Listed by Universities

A further sampling of interdisciplinary environmental research programs and centers mentioned during the site visits, which are not covered in Section A, is contained in this section.

University of Illinois

Lead Pollution Program: A University-wide program is underway which utilizes a total systems approach to the characterization of lead in the ecosystem and in food chains; to contamination of water, soil, air, and food; to measurement of its biochemical and physiological effects on plants, animals and humans; and to computer simulation of the ultimate consequences of the yearly deposition of 500 million pounds of lead throughout the United States. Comparative data is obtained from specimens collected by the Natural History Survey over the past 40 years. The engineering, economic, political, and legal aspects of eliminating lead pollution on motor vehicles is an integral factor of the study.

Center for Human Ecology: One research project within the center has been concerned with the life of people in Holms County, Mississippi, the movement of these people to two miles square in Chicago, and their subsequent life in Chicago.

Illiac IV Project: A natural resource information system is being developed by the Illiac IV Project in cooperation with the Northeast Illinois-Natural Resource Service Center. The system will contain a wide range of natural resource data for the area. By 1971 it is anticipated that a pilot system will be available for Marengo Township

in McHenry County. Data on eight natural resources will be available: soils, geology, hydrology, forestry, climatology, water impoundments, topography, and land use. Such data for each 40-acre tract will be stored in the Illiac IV computer. In addition to describing the actual resources of each 40-acre block, the system will store a library file for each resource which will describe the technical details of the resource and its consequent uses and limitations.

Indiana University

The Environmental Systems Application Center, a division of the Aerospace Research Application Center, is preparing a broad-range information system designed to help industry, municipal government, and state government to meet the urgent demands of environmental management and protection. Some of the major capabilities of the system, including important components of the environmental science and technology and environmental law services, are now operable.

University of Iowa

The Director of the Institute for Urban and Regional Research feels that the main strength of the Institute is in translating available technology to public policy and programs. There is a Committee on Environmental Research within the Institute, which has among its projects a "think piece" on environmental monitoring asking such questions as what should be monitored, how often, and what kind of systems are necessary for sorting the data. In a service role the Institute is proposing two educational programs: a series of seminars for state agency people and a set of courses for non-degree majors in urban environmental problems.

University of Michigan

The Institute for Science and Technology is an apparatus for introducing new fields into the university and for managing research activities which don't fit anywhere. Secondly, IST brings to Michigan industry new knowledge and new technology. Major programs include Biophysics, Highway Safety Research, Great Lakes Research, and the Willow Run Laboratories. The directors of research work with the deans and absorb some of the funding to launch new people and new fields. The state provides funds for IST, which maintains the flexibility over the years.

The Institute for Social Research is a long established line organization which has a great many joint appointments. This Institute has been responsible for introduction of numerous courses into

the social science departments, and has completely remade the Political Science Department, for example, due to quantitative techniques. More and more, they are getting into the social environment--the man-made social changes.

The Environmental Simulation Laboratory is part of the School of Natural Resources, and the main business of the Laboratory is urban metropolitan planning from a resource and ecological point of view. Over the past seven years, they have developed several computer gaming programs, including METRO and APEX. These programs can be used for a three-day training program or for extended course work. The participants interact at a decision-making level from a point of view of the city planner, politician, engineer, and the developer.

Michigan State University

The Campus Water Plan, which has been in the planning stages for four years, is under the direction of the Institute for Water Research. Twenty-five per cent of the effluent from the East Lansing Sewerage Treatment Plant (approximately 3 million gallons per day) will be piped 4-1/2 miles back to the campus for research purposes.
The goal of the program is to assimilate the urban wastes by means of agricultural products. This represents a new and exciting role for the agricultural engineer as well as for many other disciplines.

A research, demonstration, and teaching laboratory will be developed on 500 acres permanently dedicated to this purpose by Michigan State University. It will include a series of shallow lake impoundments, a central laboratory building, lesser structures and facilities, wooded areas, and open field plots.

The program will treat waste water as it leaves a treatment plant after primary and secondary treatment. As the waste flow proceeds through a series of lakes, it will be stripped of most of its pollutional and nutritional characteristics. Inherent in this program is the harvesting of biologically incorporated materials to remove them from the system.

To complete the cleanup and the nutrient stripping, water from the pond systems will be delivered to adjacent terrestrial sites. Here it will be distributed to forage crops, selected row crops, coniferous tree plantations, woodlands, and old field complexes. Plant growth and the quality of soil and water after the undesirable elements in the water have been removed through interaction of soil, sun, and vegetation will be determined. Again, harvesting and utilization of biologically produced materials will be a major source of nutrient management in the terrestrial system.

Within this land-water complex, they will design, test, and manage wastewater from a modern waste disposal plant in a manner whereby the nutrients and contaminants are handled as resources converting them into useful products; the water, stripped of its pollutants, can be directly utilized or returned through the soil mantle to the subterraneous aquifers to complete the hydrologic cycle.

The Kellogg Biological Station, located on Gull Lake near Battle Creek and Kalamazoo, covers an area of 1,500 acres. This Station includes a bird sanctuary, a farm, a demonstration forest, a laboratory, dormitories and housing facilities. There is a full-time staff of 41 people and 21 permanent part-time employees. During the summer there is a teaching program involving approximately 100 students. Land use activities of the Station include botany and plant pathology, crop and soil science, dairy science, entomology, forestry, and demonstration and teaching areas. It is envisioned that the Kellogg Center could develop into a public educational center in addition.

The Station provides an opportunity to ask questions on how to couple urban-industrial systems together with agricultural and semi-wild systems in some mutually compatible way. Since the Station is up-plume from Gary, Indiana, there is a fairly sizeable fallout of industrial products into the area. In addition, the pesticide fallout is very significant. The whole water relationship is under consideration, e.g., to what extent is the continual pollution of streams like the Kalamazoo River by industries along the river compatible with agricultural and wild or semi-wild land?

Pesticide Research Center: The research associated with the interdisciplinary Pesticide Research Program involved 45 individuals from eight departments last year. The pesticide analytical laboratory includes a concentration of specialized instrumentation for the 15 senior staff members and their research groups from five departments. Current research programs at the Center deal with fundamental and applied apsects of the biology and control of economic pests; the distribution, chemistry, and ecology of pesticides in soils and in terrestrial and aquatic environments; contamination of foods and feeds; modes of entry and the metabolism, physiology and toxicology of pesticides in plant, animal, and microbial systems. The interdisciplinary texture of these programs is fostered by the focal competencies and facilities of the Center and personnel located there, as well as by frequent seminars, colloquia, conferences, and informal meetings. The Center has an advisory committee composed of faculty researchers from 16 different departments.

MSU-AEC Plant Research Center: This laboratory is jointly administered by the College of Natural Sciences and the College of Agriculture, and has a staff of twelve senior people who are mostly plant physiologists and plant biochemists. The staff has joint appointments in other departments. This laboratory was established in 1964 and has as its mission basic plant science research.

The Ecological Systems Science Group is an important new group, and it is discussed under the Curriculum Section.

University of Wisconsin

A description of 33 institutes, laboratories, centers, and service facilities which are involved in activities related to environmental studies was issued in August, 1967. For example, within the School of Natural Resources there is the Center for Resource Policy Studies, the Environmental Awareness Center, the Center for Environmental Toxicology, and the Center for Environmental Communications and Education Studies. We mention below only the Biotron (which can be utilized by all CIC members) and the units affiliated with the Institute for Environmental Studies.

The Biotron is a facility of the Graduate School of the University of Wisconsin. The building provides a system of controlled environmental facilities designed as a tool for fundamental research in the biological sciences. The facilities will permit the study of the relationships of either animals or plants varying the various parameters of the physical environment. Opportunities are provided for work with variables such as air and soil temperature, light and immediately associated radiation, atmospheric moisture, air velocity and sound. An attempt has been made to permit working with most species of animals and plants. Temperature and light conditions will be such that an approach can be made to conditions occurring almost anywhere on the surface of the earth. Variables are centrally programmed and controlled with a computer.

The Biotron is available to any investigator who has a problem that is considered worthwhile by the Biotron Committee whether he is from the University of Wisconsin or not. Investigators using the Biotron will have the use of services and facilities including: controlled environment areas for experiments with animals or plants; workroom space for the setting up of special equipment; laboratories, including animal diet and feed rooms, operating rooms, necropsy rooms, plant potting rooms, plant harvesting rooms; photographic

studio and dark rooms; conference rooms; transfer rooms; media preparation rooms; use of standard Biotron equipment; animal cages, racks, and related equipment; plant trucks and containers; standard animal feeds and plant nutrients; animal and plant caretakers; standard laboratory supplies and chemicals; central data acquisition and recording facilities for standard records; and technicians and mechanics for assistance in setting up equipment and for simple repairs and maintenance.

The Marine Studies Center was established in 1967 on the Madison campus to provide a focus for marine-related research, teaching, and public service. Divisions of the Center include the Marine Research Laboratory, the Ocean Engineering Laboratory, and the advanced studies group.

The Center for Climatic Research is an interdisciplinary group devoted to the understanding of the world pattern of climate, its causes and mechanisms, its evolution in time, and the impact of climate on the patterns and changes of ecological systems. The program is structured into five divisions: Historical Climatology, Field Climatology, General Circulation Climatology, Bioclimatology, and Microclimatology.

The Lake Wingra Ecological Systems Group, funded by the International Biological Program, focuses on a single watershed, part of which is a wooded urban area, and part a large rural area. The research in this watershed is designed to answer certain questions arising from the general objectives of the Analysis of Ecosystems program, and specifically to study the impact of urban populations on land and water systems. A variety of disciplines are involved in the study.

The Water Resources Center and the Remote Sensing Program, which were described earlier, are or will be affiliated units of the IES.

C. State Surveys and Laboratories

Although the State Surveys and Laboratories are not strictly part of the state university systems, they are often closely related to the university by means of location and staff. At three of our site visits men from State Surveys or the State Hygiene Lab were present at our group discussions, and their units are mentioned briefly below. These state organizations provide a valuable source of information, data, and services.

Illinois has three state surveys--Geological, Water, and Natural History--which are not part of the University, but are closely related to the University by means of staff joint appointments, sponsored research, and graduate student research. The function of the surveys is information gathering and research. The survey's board and the University are mutually charged by law to cooperate.

The Illinois Geological Survey has a professional staff of 80 people and for the past seven years has had a progran in environmental geology. It is a research and action agency, but they employ many graduate students. The environmental geology program is slanted towards the use of geology and earth science for public health, engineering and the mineral industries, including a study of strip mining practices. There is a large research program in solid waste disposal sites for the state, and on the effects of solid waste on the ground water and environmental health. The Survey has been increasingly involved in land use planning, industrial plant location, and mineral resources development. For the past several years, Survey scientists have been studying in detail the bottom sediments in Lake Michigan.

The Illinois Natural History Survey is 115 years old and is charged by law to collect, classify, and preserve the flora and fauna of Illinois. Some of the finest collections in the world have been preserved and provide a good foundation to compare some of the ecological changes which have occurred. The Agricultural Experiment Station provides support for the Survey. The Survey will construct 16 1/4-acre interconnected ponds which will be located on an Experiment Station farm to study aquatic contaminants.

The Indiana Geological Survey is a division of the Department of Natural Resources, and is related to Indiana University through physical location and fiscal administration. The staff of the Survey in its research programs has strong ties to the University, particularly in the area of environmental geology. The Survey provides geologic information related to land resources, construction sites, and waste disposal.

The Iowa State Hygiene Laboratory is a unit of the University of Iowa and is also the technical arm of the state water pollution and the air pollution control commissions. Members of the staff participate in various College of Medicine and University committees. However, they do not hold faculty status. The Environmental Science Services Division within the laboratory includes radiological health, limnology, industrial hygiene, chemistry, air pollution surveillance, water pollution surveillance, and consumer products.

V. UNIVERSITY EXTERNAL AFFAIRS

Public Service, External Affairs, Advisory and Information Services are all names used by various university environmental committees and centers to denote a function which they value highly and list along with teaching and research as one of their three major functions.

It is a function with a long history in the CIC Universities, but which carries with it a new sense of urgency in the face of an environmental crisis, which is truly every man's crisis. The rough division of external affairs into advisory services and public information services is a good one. It is to the university that the government looks for expert information and scientists without conflicting interests; it is to the university that the public looks for the interpretation of science and of the policy related to science.

In the area of public information, the CIC Universities are provided with some established means for meeting these needs. At six of the CIC Universities, the cooperative extension service has provided an outlet which has been very effective in disseminating the universities' knowledge in agriculture and is now moving into other areas. Along with the cooperative extension, most of the universities have a general extension program to serve the non-rural needs. Another approach to public information can be seen at the University of Indiana, where the Science and Society Committee of the Indiana Academy of Sciences has provided a half-time man with an office in the state capitol to help find ways of bringing science to the people.

In terms of the universities' advisory role to the state and local governments, there are two main mechanisms now in operation--the informal relations of individual faculty members and the cooperation with the state surveys and laboratories. One university poll indicated that a full 25% of its faculty members were involved in some advisory capacity to government, and this seems to be a pretty good figure for most of the CIC institutions. The ties with the state surveys and laboratories also exist on almost every campus and consist of such things as joint appointments, graduate student support, and state-sponsored research.

Both the public information and the advisory roles of the various university environmental units are made much more difficult by the very nature of the problem. It is not only a matter of technical information but of public policy and public attitude.

The older institutions of public information, which are tied to specific clientele, have difficulties adjusting their attitudes to cover broader environmental concerns. For example, we still have extension staff recommending DDT against the strong protests of resident biologists.

The individual advisory relationships are inadequate to a massive interdisciplinary problem. Thus, the universities are seeking new and more extensive relationships in an advisory capacity and better and more complete methods of reaching the public to provide information. The new state legislation in Illinois and Iowa may provide the universities with a more formal input to state standards and controls; and new intra-state, inter-university organizations, such as the Iowa Inter-Institutional Committee on Environmental Studies and the proposed Ohio Inter-University Environmental Council (Ref. 7) will seek to expand the universities role in both advisory and information services.

While these efforts go on at the administrative level, the students continue to rush in where others fear to tread, and we report about their activities in this area in the next section.

VI. STUDENT ENVIRONMENTAL ACTIVITIES

Following Earth-Day 1970, the number of organized student environmental groups on the CIC campuses declined from some 12-15 on the most active campuses, to a stable level of around 1-3. Most of the CIC campuses have one main student group, with a more or less permanent office and membership open to the community. In addition, many also have chapters of the Student Environmental Law Society and some have special environmental groups in the areas of Engineering or Ecology. Since the structure and activities of these several types of groups varies greatly from campus to campus, we will present a summary of their structures along with some of the highlights of their activities. A directory of student organizations is available in Appendix C.

There are several things to note about student groups in general--and, we think, a number of things administrators could learn from communicating with these groups. In more than one instance, we found groups of students tackling problems which seemed clearly to lie within the proper province of the University administration--the creation of a library for instance, or the offering of community education programs, or the creation of courses within the University. We are not saying that the students should not be active in these areas--on the contrary--but the cooperation received by the students was not always very good even though some administrators seemed perfectly willing to take the credit for things that "their" students were doing.

The scale of operations of some of these groups might surprise many people. The University of Michigan group, ENACT, split into two groups and are maintaining an action office on campus and an ecology information center in town. The Northwestern Students for a Better Environment have been conducting regular public education courses and consumer information programs, and actively seeking and obtaining funds from the community. But it must be remembered that even these most impressive of the student programs are run by only few in a period of great public concern. The majority of the students on every campus remain seemingly unaffected by the environment fervor.

In this section we discuss briefly how the student groups are organized, student efforts at curriculum development, research, and student action projects.

A. Types of Student Organizations

For the sake of discussion student environmental groups may be characterized as coordinating and support offices, action groups, and research groups.

1. Coordinating and Support Offices

Two approaches to the formation of a central office may be seen at Michigan State University and the University of Wisconsin. At Michigan State University there is an Environmental Action Office, set up by the provost's office with a paid staff of young faculty and students. The functions of the office are very broad (including such things as: curriculum development, community information, access go administration, inter-group coordination) and flexible, but are all aimed at serving the needs of individuals and groups attempting to set up environmental programs. This includes community people as well as students and faculty. At Wisconsin, the Hoofers (Wis. Outing Club) have set up an Ecology Information Center, supported by the Hoofers and serving much the same functions.

2. Action Groups

The most active of these (at Illinois, Northwestern, and Michigan) have permanent offices either on or off-campus, a good sized core of people--sometimes including paid staff, and a substantial operating budget. Off-campus financial support is sought.

3. Environmental Research Groups

On several campuses there exist student research groups. Some of these are fragments of action groups--and in this case are usually dominated by graduate students and remain closely tied to the action group. In other cases new research groups have been organized--sometimes by undergraduates--usually with a faculty advisor.

B. Curriculum Development

Student groups have taken an interest in curriculum development at a number of universities and in a variety of ways.

1. The Environmental Action Office at Michigan State University provides students with direct access to the administration and serves as a focus for development of student ideas on curriculum.

2. The student group at the University of Illinois is working on a proposal to bring local government officials into the classroom to share knowledge and experiences.

3. The Northwestern Students for a Better Environment have developed a couple of courses which will be offered for credit. One is a survey course on environmental problems, the other a course on population. In addition, they hope to offer a course titled "Special Problems in Pollution" and to help students with independent research.

4. The Summer Curriculum Group at the University of Wisconsin, three-fourths of whom were students, produced a design for an introductory environmental studies course, a paper on their philosophy of environmental education, and a number of papers of what will eventually be part of an environmental studies curriculum.

5. The Students for Environmental Control at the University of Illinois have prepared a paper presenting their views on Environmental curriculum development.

Individual students have a variety of opportunities to participate in the design of their own education.

1. The University College at the University of Minnesota--though it has relatively stiff admissions requirements and only serves a small percentage of the population--offers students a chance to design their own curriculum and several interdisciplinary environmental studies programs have been put together under its auspices. Some of the student leadership in environmental affairs seems to come from this college.

2. The New University at Northwestern offers two mechanisms by which new courses may be introduced, both of which are expected to play a role in meeting the need for environment oriented courses.

   a. Any 10 students can set up a seminar with lower division credit.

   b. Any 30 students can petition a department to teach a specific course.

3. There are two noteworthy programs at the University of Indiana.

a. An interdisciplinary research seminar (initiated by students) open to honors students, which provides for any number of faculty members to get together on a specific project--each bringing three students.

b. The "J" series of courses which provide for a credit course to be initiated by any group of students, if they can find a faculty member willing to teach it (for free). The course is in effect for one year, and then a decision is made as to whether to incorporate it into the curriculum. (Few courses make it past this hurdle). There seems to be good use of the "J" courses for environmental studies with some activity by people on the residence hall councils to initiate environmental "J" courses within the halls.

C. Research

Action Groups are conducting research in many cases often in the area of air or water quality monitoring. This information being used as background for public information programs--but also as input to University curriculum in the form of material or data for project type courses. In addition, there are a number of groups organized specifically for research purposes. The NSF Student Originated Research Program has spurred much of this activity, but in some cases there is also University support (in the form of credit or money) for student research group.

Individual research on environmental problems--whether departmental or interdisciplinary, is to be expected at the graduate level. But it is also beginning to show--although very slowly and in limited scope--in the undergraduate field. For example, student research is now required at Purdue for the B.S. in Environmental Science.

D. Action Projects

The kinds of action undertaken at the various schools are somewhat similar--the variation being largely in scale of operations. There are students active in the initiation of legislation at many Universities:

1. The Northwestern Students for a Better Environment have been helping with the drafting of city environmental ordinances.

2. A group of law students at the University of Michigan worked on the drafting and lobbying for a successful state bill allowing the individual to sue in cases of pollution.

The ENACT group at the University of Michigan has developed a good working relationship with the United Auto Workers, and students are expected to become active with union members working toward elimination of both in-plant and extra-plant pollution problems.

In addition to direct action many student groups are working on research projects to build up the case for future action and to supply information to local community activist groups.

1. The Engineers and Scientists for Social Responsibility at the University of Wisconsin published a series of newspaper reports on Madison's air, water and solid waste problems.

2. The undergraduate research group at Purdue is working on a survey of environmental problems--action on which will be taken over by the Local Chapter of the Isaac Walton League.

Two major attempts to influence external policy have been "Campaign GM" and "Curb Com. Ed." in which groups of students attempted to persuade the University to pledge its stock to an organized campaign to effect changes in a companies policy through stockholder pressure. This sort of pressure seems likely to continue.

The campus environment is a major focus for many student groups:

1. The University of Illinois group staged a massive cleanup of a creek running through the campus.

2. The Ecology Students Association at the University of Wisconsin presented the University administration with a list of 33 campus environmental problems--and has been systematically working toward the elimination of these. They won a major victory in the preservation of a marsh on campus.

3. A number of student groups have become active in campus planning. The involvement of individual students in the making of University policy is less dramatic than that of the groups, but many students feel that if this was carried farther, student interests would be adequately represented and the banding together for confrontation would not be necessary.

Students early realized that one of their functions had to be public information--the buildup of a general awareness. So that the April 22 teach-ins were not limited to the campus, but open to the community and in many cases events were held far away from the campus to encourage community participation. Most of the teach-in planning groups were made up partly of local citizens--in some cases up to 50%.

The community information function has been carried on since the teach-in.

1. The Northwestern Students for a Better Environment offer an adult evening program at the township high school with courses titled "Population" and "ecology-pollution-society."

2. The Ecology Students Association of the University of Wisconsin is conducting an information campaign on Shell No-Pest Strips, aimed at restaurant workers.

3. The ENACT ecology center at the University of Michigan exists solely to serve the Ann Arbor community.

4. The Student group at Illinois is petitioning for a position titled "Community Professor."

5. "Free Universities" have existed for several years at many of the CIC campuses and have been devoting increased attention to environmental issues with the help of student groups.

In addition to supplying information some groups carry on a service function such as the complaint center maintained by the Illinois group or the speakers bureaus which almost every group maintains--to provide citizens groups access to speakers from the University.

VII. RATIONALE BEHIND THE FORMATION OF NEW ENVIRONMENTAL INSTITUTES

We have noted in this report that many new university-wide institutes are in various stages of formation, and that the environmental concern is spread deeply into a great many disciplines, research programs, and student groups. In this section we indicate some considerations given to the formation of new university-wide units for environmental studies at several of the CIC Universities. From the many discussions we had during the site visits, we present here four exerpts which reflect some of the thoughts with respect to the formation of new Environmental Institutes. Other comments, questions and quotations are listed in Appendix D.

Indiana University (Quote from Professor Caldwell)

To surmount the environmental crisis, a major effort will be necessary to orient and motivate the coming generation of decision-makers. In this effort the schools of America have a major role and responsibility. No where is the need for action greater than in the colleges and universities and especially during the undergraduate years. It is at this stage of development of intellect and personality that the direction of future leadership appears. At this point in life, young men and women begin to make articulate their personal values and to select the criteria by which they will make future decisions. In the past whatever its merits, undergraduate college education did not adequately assist students in this all important phase of growth. We now know, or should have learned, that intellectual or technical proficiency alone cannot provide sufficient foundation for making the moral decisions and value judgments of life. If undergraduate education is to help resolve the inner crisis of purpose which underlies the external crisis of environment, a more valid set of goals and objectives will be required.

University of Michigan (Extracted from Tape Recordings During Round-Table Discussion)

The creation of new units is not always necessary, but there are times when things are not likely to go forward unless you create something that is a structure for new programs (e.g., the Highway Safety Program). But the departmental roots of senior people must be

preserved and new people must have roots in some department for quality control purposes, also to facilitate graduate thesis work. For the environment, a great many departments must be involved, and to make an organization that would structure all these interests would be unmanageable. Our feeling was we need in the environmental field a loose, umbrella organization that would not structure, but would foster and facilitate developments anywhere in the University in this field.

One of the areas to which we give the highest priority is to start producing a new type of graduate student. In many ways, the fellowship system of the past is solidly discipline-oriented. We need graduate fellowships for students motivated in the interdisciplinary environmental areas, who in many cases would not get support because their interests were not "correct."

Secondly, we need to help the departments bring in people to faculty positions who have a career of research interests in environmental questions which they will pursue from an interdisciplinary base. Some such people might find a home in the School of Natural Resources as it develops, but the opportunities are very much broader. We hope to bring about new appointments in departments with IEQ money and to bring about new combinations of faculty. Also, we will use some funds for venture capital for research and for development of new courses. The IEQ would not do it, but would act as the catalyst. The Institute is not a line structured research operation and does not take away the autonomy of groups already in the field. The Director of IEQ must be an artist--creative use of contacts, building bridges, bring in new people, restructuring some courses. It is an experiment; we have not tried it before.

In many instances we are getting a different type of young faculty member today as compared to a decade ago. He is less classically discipline limited than the man who knew one field well but was not interested in other disciplines. The new breed is not professionally possessive about their field. And hence, it is much easier to stimulate new arrangements than in the past.

Simply waiting for faculty to introduce environmental concern to their courses is not going to bring about a very great change. On the other hand, the total university investment in environmental areas is so vast that building something entirely new does not seem to be appropriate. And thus, we arrived at a facilitating, fostering, catalytic type of organization.

Do you agree with the conclusions of the Steinhart report? Yes, except there are a variety of ways you can guarantee the place in the reward system and the logistic base for people active in interdepartmental programs. For example, with joint appointments in the Institute for Social Research or the Institute for Science and Technology, a large part of the person's salary is based in the Institute and, therefore, there is a high degree of leverage in the reward system. Also, we have four interdepartmental programs that are receiving independent funds directly from the University; we still insist, however, that the faculty appointments pass through the departments. It is not likely that professional titles will be given solely by interdepartmental units.

There are two colleges which are essentially interdepartmental --Natural Resources and Public Health--and mission-oriented. There is no common denominator to the faculty training. One solution is to have interdepartmental departments.

From the student point of view, interdepartmental programs present a special funding problem because departments tend to give their support first to their own students. Thus, interdepartmental programs need some independent funds. Of course, the uniqueness of interdepartmental students is becoming less evident. In fact, you can arrange a two-dimensional grid with the departments on one axis and the interdepartmental programs on the other axis. The intellectual climate is changing fast in this direction and the financial climate must change accordingly. And most importantly, physical space for interdepartmental programs must be made available.

Michigan State University (Extracted from
Tape Recordings During Round-Table Discussion)

Before forming the Institute at Michigan State, the Steinhart Report (Ref. 1) was considered. It seemed that this was not the route to go because there was a big contradiction involved in the report. On the one hand, the report said that to have a successful program in the Environmental Quality Center, you should have a department that is essentially addressed to the broad problem and have the rewards of promotion and other finances attached to the unit. At the same time, it was recognized that the problems of environmental policy cut across a very large segment of the University. This is not resolved in the report. The posture that we took was that it was desirable to have all-University approval on the question of environmental quality, and that

it was essential to build on the existing programs and strengths which are already interdisciplinary in nature, rather than to set up a competitive unit. Before the Center was established, the endorsement of the Deans, the Educational Policy Committee, the Academic Council, and the Board of Trustees was sought. Early in the discussions and negotiations, and looming very large in all of this was the so-called systems approach to environmental problems. Also, in terms of the total program, not only is there the need for curriculum development and all sorts of research programs, but in addition continuing education should be included. The continuing education people have been extremely zealous in their participation.

The total University resources have to be available for solutions of environmental problems, but it is essential that the University assess what their proper role is, and to establish the appropriate priorities. The Center can be effective in saying what the University should not attempt as well as what it should attempt.

University of Wisconsin (Quoted from UW Faculty Document 279)

The integrating focus of the Institute for Environmental Studies is the man-environment system: the relationships between man, individually and collectively, and his natural and man-made environment. A definition of environmental studies must include the following factors:

1. We are concerned with the environment of man. Research findings have identified relationships between physical surroundings and human performance, have found that physiological health and physiological well-being are affected by environmental variables, and have determined that social behavior is influenced by elements of the environment. Man, in turn, exercises profound effects on his environment. The focus, additionally, must be upon the growing numbers of humans concentrating in increasing densities and bringing greater pressures to bear upon the natural and the constructed environment.

2. We are concerned with the total environment: its social, cultural, economic, and aesthetic as well as physical and biological aspects. Within the University the cumulative effect of the efforts of the humanities, engineering, social sciences, biological sciences, physical sciences, medical sciences, and the attendant professions must be considered in looking at the total environment of man. To seek an optimum total environment requires both an understanding of human needs as well as the needs of healthy,

living, natural, and man-made environments, in which a certain amount of creative disorder is essential for natural evolution and human creativity to continue. Any discussion of the goals of individuals and of society must quickly draw upon a knowledge of the nature of the world in which man lives, just as any discussion of a balance of nature today must take into account the necessary impingements of man.

3. We are concerned with <u>interdisciplinary</u> studies. The development and management of an optimum total human environment requires an understanding of the contributions which can and must be made individually and collectively by all the arts, sciences, and professions.

4. We are concerned with integrated studies that have as their ultimate rationale the development of <u>open-ended</u> solutions for environmental problems, rather than short-term solutions that may degrade the environment or actually hasten man's extinction. We are concerned with the application and adjustment of designed time and space for optimum human performance within the carrying capacities of the environment, and without the destruction of natural evolutionary reserves that are necessary for survival. The desired objective is to bring conflicting forces into functional relationships, so that human impact does not needlessly destroy earth quality, and that earth qualities contribute to more fruitful human life without destroying the heterogeneity of existing flora and fauna that are desirable for a viable evolutionary continuum or the heterogeneity required for the continued development of man.

5. While we recognize the essential importance of strengthening existing disciplines, we look toward teaching, research, and extension configurations that will <u>transcend</u> traditional lines of endeavor and be concerned with wholeness of the relationship between man and the total environment. In a real sense, we seek to provide a university environment in which integrated environmental studies can be accomplished and in which the fruits of such research can be reflected in improved campus teaching, and community service.

6. We are concerned, finally, with <u>quantitative</u> answers, for the problems are so complex that we must know which factors are more important and which actions may have consequences far larger than their apparent significance.

VIII. CONCLUSIONS AND RECOMMENDATIONS

Extensive and diversified activities pertaining to the widespread environmental concern are presently underway at the CIC Universities in the areas of administration, teaching, and research. In addition to the vast array of "business as usual" activities at the universities, there is a new intellectual focus emerging: the interdisciplinary study of man and his relationships to the natural and man-made environment. This, in the broadest sense, is what is meant by the term "Environmental Studies."

In response to the environmental concern, seven out of the eleven CIC Universities have established, or are in the process of establishing, university-wide Environmental Studies Centers or Institutes. With respect to the environment, the problems are so severe and complex, and the future of man is sufficiently in doubt, that many of the people contacted expressed the necessity to create new structures for new programs. The style of these new units vary considerably, and the mechanisms for staffing and developing programs are in a state of flux. The dilemma which must be reconciled is that the theoretical solution of environmental problems may lead to nearly every discipline at a university, while without a generalist viewpoint, the proper questions may never be raised.

The status of new university-wide units is changing rapidly and in several cases progress has been made since the site visits. Funding of these units is, of course, a problem, and at the time of the site visits, only one of the universities had received external funds. Two of the universities cited lack of funds as the reason for not recommending the formation of a new university-wide unit.

A great variety of new environmentally-oriented courses are being developed in a great many disciplines. The new environmental focus requires interdisciplinary efforts, and to be successful the faculty involved need to be actively working with each other across disciplinary lines. Joint appointments provide one mechanism to achieve this; however, this does not seem to be sufficient in all cases.

There appears to be a scarcity of integrative attempts at curriculum development, and this seems to be particularly needed at the undergraduate level. Hopefully, the new institutes will fill this need.

At the research level, there are so many institutes, centers, and groups, federal agencies, and professional societies that we believe that the short-term research will be effectively accomplished without major organizational changes. However, the long-term research related to the "future of man" and the "quality of life" requires the stability and stimulation that should be provided by new instrumentalities at our universities.

Student groups at all the campuses have demonstrated vigor and strength which transcends the Earth Day activities and rightly qualifies as a "movement." Some students have organized truly interdisciplinary groups. Their activities frequently extend into the communities where they are making a concerted effort to be constructive, but will not shy from direct action. However, the "movement" encompasses only a small number of students, while discontent and uncertainty is probably more widespread.

The state governments in the seven states of the CIC Universities are experiencing a flurry of environmental legislation. For example, the State of Illinois recently passed the Environmental Protection Act which establishes a new Environmental Quality Institute for the State of Illinois, and authorizes a $750 million bond issue for pollution cleanup. New state legislation will elicit new responses from the state universities to meet the needs of government, industry, and the individual citizen. The universities must be organized to respond effectively.

Recommendations for the CIC

On the basis of our experience of traveling to each of the CIC campuses during this past summer and fall, we would like to make the following recommendations:

1. The CIC, as a group should continue to concentrate on specialized and limited projects of teaching and research rather than overextend its limited resources and influence.

2. The CIC should sponsor a workshop for faculty and students during the summer of 1971 on the subject of innovative development of undergraduate curriculum in environmental studies and, in particular, the development of man-environment courses. As noted in Appendix B, many courses of this type are being developed, and many of the people involved endorsed such a workshop session.

3. The CIC should sponsor a workshop for faculty, students, private industry, and government agency officials to discuss the development of professional Master's degree curricula in "Environmental Management" and their relationship to manpower needs. Some faculty and students feel that such a Master's degree program is urgently needed, but it is not clear who would be able to employ the graduates from this program.

4. The CIC Office should retain on file all pertinent documents relating to the formation and operations of environmental institutes in the CIC and make these available upon request. Since the concept of these institutes is new and experimental, a sharing of experiences is desirable.

5. The CIC should try to make better use of the off-campus land holdings by cooperative use of the land where appropriate. There are two major advantages to this cooperation: a) to provide a diversity of conditions and b) to provide blocks of land which are large enough to prevent intrusion. The CIC Office should keep an inventory of all the pertinent land holdings. A start for this inventory is provided in Appendix E.

APPENDIX A

PERSONS CONTACTED DURING SITE VISITS

The following administration and faculty personnel were contacted during the site visits. Students were also contacted, but they are not listed. The first person listed at each university was the primary contact and was responsible for arranging the visit.

University of Chicago (July 14, 1970)

J. Meltzer	Director of Center for Urban Studies. Professor of Social Science. CIC Contact.
A. W. Ravin	Associate Dean and Professor of Biology. (Telephone conversation only)

University of Illinois (July 23 and 24, 1970)

G. W. Salisbury	Director of Agricultural Experiment Station. Associate Dean of College of Agriculture. CIC Contact.
S. R. Aldrich	Professor of Agronomy
T. F. Anderson	Professor of Geology
K. E. Bergstrom	State Geological Survey
L. F. Blair	Professor of Urban Planning
G. Bugliarello	Dean of College of Engineering, Chicago Circle Campus
B. B. Ewing	Professor of Civil and Nuclear Engineering. Director Water Resources Center.
L. L. Getz	Professor of Zoology
W. Goodman	Professor of Urban Planning
A. F. Graziano	Assistant to the Vice Chancellor for Academic Affairs
S. C. Kendeigh	Professor of Zoology

University of Illinois (Continued)

N. D. Levine	Director of Center for Human Ecology. Professor of Veterinary Research.
W. H. Luckmann	Natural History Survey. Professor of Agricultural Entomology.
J. E. Pearson	Professor of General, Sanitary, and Nuclear Engineering
J. T. Pfeffer	Professor of Sanitary Engineering
D. L. Slotnick	Professor of Computer Science. Director of Illiac IV Project.
R. A. Strehlow	Professor of Aeronautical and Astronautical Engineering
J. J. Stukel	Professor of Mechanical and Civil Engineering
E. R. Swanson	Professor of Farm and Production Management
A. S. Weller	Dean of College of Fine and Applied Art

Indiana University (September 18, 1970)

H. G. Ludlow	Associate Dean of Research and Advanced Studies. CIC Contact.
L. K. Caldwell	Professor of Political Science
W. B. DeVille	Director of Environmental Systems Applications Center
W. G. Meinschein	Professor of Geochemistry
C. E. Nelson	Professor of Zoology
M. Reshkin	Professor of Geology, Gary Campus
R. Ruhe	Director of Water Resources Center
W. Scott	Arts and Sciences
P. Whitaker	Professor of Conservation Education
D. R. Winslow	Division of Regional Campuses

University of Iowa (September 14, 1970)

L. D. Henry	Assistant to the Vice President for Educational Development and Research. CIC Contact.
R. W. Bovbjerg	Professor of Zoology
W. L. Boyd	President
K. J. Dueker	Professor of Urban and Regional Planning
W. J. Hausler	Director of State Bacteriological Laboratory
N. W. Hines	Professor of Law
F. E. Horton	Professor of Urban and Regional Planning
K. R. Lang	Professor of Preventive Medicine and Environmental Health
B. L. Meyers	Professor of Civil Engineering
R. T. Skrinde	Professor of Civil Engineering
D. Spriestersbach	Vice President for Educational Development and Research. Dean of Graduate College.
M. D. Zenov	Associate Dean and Director of Institute of Public Affairs

University of Michigan (September 10 and 11, 1970)

S. B. Preston	Professor of Natural Resources. CIC Contact.
J. E. Bardach	Professor of Fisheries
J. W. Bulkley	Professor of Civil Engineering and Natural Resources
S. A. Cain	Director of Institute for Environmental Quality
R. A. Cellarius	Professor of Botany
H. H. Cornish	Professor of Industrial Health
W. D. Drake	Chairman of Ph.D. Program in Urban and Regional Planning. Professor of Natural Resources.

University of Michigan (Continued)

D. H. Gray	Professor of Civil Engineering
S. W. Havlick	Professor of Resource Planning and Conservation
M. S. Hilbert	Chairman and Professor of Environmental Health
W. C. Jolly	Staff Assistant, Institute for Environmental Quality
S. D. Marquis	Professor of Resource Planning and Conservation
J. T. McFadden	Dean of School of Natural Resources
A. G. Norman	Vice President for Research
J. L. Sax	Professor of Law
S. H. Spurr	Dean of Graduate School
A. S. Sussman	Acting Dean of College of LSA
G. VanWylen	Dean of College of Engineering

Michigan State University (July 28, 1970)

J. E. Nellor	Assistant Vice President for Research Development. CIC Contact.
L. Boger	Dean of College of Agriculture and Natural Resources
J. Butcher	Assistant Dean of College of Natural Science
R. Byerrum	Dean of College of Natural Science
J. E. Cantlon	Provost. Chairman of CIC Conference Group on Environmental Studies.
W. Cooper	Professor of Zoology
R. D. Jackson	Campus Minister, United Ministries in Higher Education
H. Koenig	Chairman of Electrical Engineering
L. Leighty	Professor of Natural Resources

Michigan State University (Continued)

M. E. Muelder	Vice President for Research Development
H. Tannor	Director of Natural Resources
L. Von Tersch	Dean of College of Engineering
R. W. Wilson	Professor of Natural Science

University of Minnesota (September 1, 1970)

J. R. Borchert	Director of Center for Urban and Regional Affairs. (Arranged Schedule.)
J. E. Anderson	Professor of Mechanical Engineering
R. G. Bond	Professor of Environmental Health
A. J. Linck	Assistant Director of Agricultural Experiment
R. A. Swalin	Associate Dean of Institute of Technology
W. C. Walton	Director of Water Resources Center
D. B. White	Professor of Horticulture

Northwestern University (July 13, 1970)

R. F. Acker	Assistant Dean of Faculties for Research. CIC Contact.
D. W. Berry	Professor of Civil Engineering, Urban Systems
W. T. Brazelton	Associate Dean of Technological Institute
R. A. Burton	Chairman of Mechanical Engineering
E. B. Espenshade, Jr.	Chairman of Geography Department
L. I. Gilbert	Chairman of Biological Sciences
G. T. Okita	Chairman of Pharmacology

Northwestern University (Continued)

J. E. Quon	Professor of Civil Engineering
A. Schnaiberg	Professor of Sociology

The Ohio State University (October 9, 1970)

W. J. Gealy	Associate Director for Development, Ohio State Research Foundation. CIC Contact.
T. J. Curtin	Associate Director of Research Development, Ohio State University Research Foundation
R. E. Geyer	Assistant to Dean of Agriculture and Home Economics
W. L. Hamilton	Research Associate, Institute for Polar Studies
G. Keller	Dean of College of Mathematics and Physical Sciences
G. L. Nelson	Chairman of Agricultural Engineering
T. A. Seliga	Professor of Electrical Engineering
R. C. Stephenson	Vice Provost and Director of Ohio State University Research Foundation
G. S. Taylor	Professor of Agronomy
D. R. Washington	Director of Water Resources Center

Purdue University (July 21, 1970)

J. E. Christian	Director of Institute for Environmental Health. Chairman of Bionucleonics. CIC Contact.
W. W. Carlton	Professor of Veterinary Physiology
J. E. Etzel	Professor of Sanitary Engineering
J. R. Foley	Professor of Agricultural Engineering
W. G. Hansen	Professor of Bionucleonics

Purdue University (Continued)

J. W. Hicks	Executive Assistant to the President. Chairman of CIC.
B. J. Liska	Professor of Animal Science
T. S. Miya	Chairman of Pharmacology and Toxicology
G. M. Neher	Professor of Veterinary Physiology
L. Walker	Administrative Assistant of Institute for Environmental Health
D. Wiersma	Director of Water Resources Center

University of Wisconsin (October 2, 1970)

E. R. Rude	Associate Dean of Graduate School. (Arranged Schedule.)
R. A. Bryson	Director of Institute for Environmental Studies
J. L. Clapp	Professor of Civil Engineering
E. D. Cronon	Director of Institute of Humanities. Professor of History
J. A. Duffie	Director of University-Industry Research Program.
C. A. Engman	Vice President for Administration
H. C. Jordahl	Professor of Urban and Regional Planning
D. J. Klinefelter	Assistant to Director of Institute for Environmental Studies
W. R. Marshall	Associate Dean of College of Engineering
R. A. Ragotzkie	Director of Marine Studies Center
G. A. Rohlich	Director of Water Resources Center. Professor of Civil Engineering.
J. E. Ross	Associate Director of Institute for Environmental Studies

University of Wisconsin (Continued)

C. P. Runge	Professor of Law
S. C. Smith	Associate Dean of School of Natural Resources
J. B. Wilson	Professor of Bacteriology

APPENDIX B
LIST OF NEW ENVIRONMENTAL COURSES

University of Chicago

Biology 126.	Concepts in Ecology, G. Rosenthal.
Biology 146.	Man, Environment and Disease, J. E. Bowman, P. Schlesinger.
Biology 149.	Social Issues in Biology, D. Janzen.

University of Illinois

Biology 312.	Environmental Biology.
Biology 412.	Analysis and Control of Natural Environments.
Anthropology/Geography/Health Education/Physiology/Psychology/ Sociology/Veterinary Medicine 374,	Problems in Human Ecology.
Agronomy 319.	Environment and Plant Ecosystems, D. C. Koepp.

Indiana University

Government 671.	Environmental Administration, L. Caldwell.
J. Series (Experimental).	Eco-Crisis I: Present Status of the Eco-System, D. Whitehead.
	Eco-Crisis II: Status of Corrective Action on the Eco-Systems, D. Whitehead.
	Politics of Environmental Management, Kronenberg.
	Environment and Man, C. E. Nelson.
Honors Series.	Crisis Biology, C. E. Nelson.
	Environment and Society

University of Iowa

Geology.	A Planet in Crises: Earth Resources vs. Man, K. Swett.
Economics.	Economics of Environmental Quality, Pogue.
Anthropology/Civil Engineering/Geography.	Perspectives on Man and Environmental Issues.
Law.	Environmental Pollution in Eastern Iowa: Approaches to Action, A. Widiss, N. Hines.
Business Administration.	Industry and the Natural Environment, B. Schoner.
Geography.	Natural Environment and Man, J. Gardner.
Engineering.	Technology and Society, B. Meyers.

University of Michigan

Zoology/Natural Resources 201.	Man and Environment, Bardach.
Biology 102.	Human Population Ecology.
Natural Resources 454.	Ecological Problems in Human Settlement, S. W. Havlick.
L.S.A. 320.	Introduction to Environmental Studies, Cellarius, Kaplan.
Geography/Engineering 458.	Man's Impact on the Environment, D. H. Graz and Detwyler.
Engineering 195.	Man and his Environment, D. H. Grez and W. R. Kuhn.
Engineering 598.	Political Factors in Environmental and Water Resources Engineering, J. W. Bulkley.
Natural Resources.	Natural Resources Ecology (TV Tape), Lennard.

Michigan State University

Zoology 391. A Multidisciplinary View of Human Population Growth, W. Cooper, R. Wilson.

Engineering/Biology 801.
Introduction to the Design and Management of Environmental Processes, H. Koenig, W. Cooper, G. Coulman, W. Kilmer.

University of Minnesota

Ecology 51. Ecology and Man.

Social Science/Engineering 82.
Ecology, Technology and Society, J. E. Anderson.

Northwestern University

Engineering B01. Engineering Man's Environment, J. Quon.

Engineering B02. Managing and Planning Man's Environment, H. B. Gotaas.

Purdue University

Pharmacology 206. Man, Drugs and Chemicals, T. S. Miya.

Pharmacology 555. Elements of Environmental Toxicology, Mennear.

Agriculture. Man and His Food, B. Liska.

Bionucleonics. Environmental Quality, J. E. Christian.

Biology. Human Ecology, J. A. Chiscon.

University of Wisconsin

IES 101. Forum on the Environment, J. Steinhart.

Physics/IES 108. Physics in the Contemporary World, R. H. March.

University of Wisconsin (Continued)

Geography/Meteorology/IES 121.
Atmospheric Environment of Man, W. Wendland.

Geography/IES 127.
Physical Systems of the Environment, D. R. Currey, J. C. Knox.

Soil Science/Geography/IES 230.
Man's Use of the Soil, R. J. Muckenhirn.

Wildlife Ecology/IES 300.
Environmental Resource Management, C. Schoenfeld.

Geography/IES 350.
Conservation of Natural Resources, F. D. Hole.

Political Science/IES 504.
Science and Government, J. L. McCamy.

APPENDIX C

DIRECTORY OF STUDENT ENVIRONMENTAL GROUPS

Chicago	Student Environmental Law Society c/o Student Organization Office Laird Bell Law Quadrangle 1111 E. 60th Street, Chicago, Illinois Telephone: 312-643-2418
Illinois	Students for Environmental Control 1001 S. Wright Street Champaign, Illinois Telephone: 217-344-1351
Indiana	Committee to Publicize Crisis Biology c/o Professor Donald R. Whitehead Department of Botany Bloomington, Indiana 47401
Iowa	Project Survival Wesley House 120 N. Dubuque Street Iowa City, Iowa
Michigan	ENACT Room 146F Natural Resources Building Ann Arbor, Michigan Telephone: 313-764-4410
Michigan State	Environmental Action Office North Kedzie Laboratory East Lansing, Michigan 48823 Telephone: 517-355-6667
Minnesota	No Information
Northewestern	Northwestern Students for a Better Environment Room 157, Cresap Laboratory Evanston, Illinois 60201 Telephone: 312-491-9627
Ohio State	Earth Day Committee Telephone: 614-293-7819
Purdue	Student Environmental Research Group c/o Professor John E. Christian Environmental Health Institute Lafayette, Indiana 47907
Wisconsin	Hoofers Ecology Information Center Wisconsin Union Madison, Wisconsin 53703 Telephone: 608-262-3544

APPENDIX D

TROUBLING QUESTIONS AND RANDOM QUOTATIONS

Teaching

--Who pays for the TA's in an interdepartmental course?
--Who pays for the civil service staff support in an interdepartmental course?
--How are team-taught courses coordinated?
--How are "laundry-list" type lecture courses integrated?
--If you are teaching an undergraduate course aimed at providing a basic "environmental awareness," how do you tell when you have achieved it?
--What is the relationship of applied research projects to undergraduate and graduate teaching programs?
--How does interdisciplinary teaching get proper recognition in the reward structure?
--What is the proper balance between awareness vs. transmitting a body of knowledge, and between specialty and generality?

Research

--Can you set up a top quality applied research program or will scientists tend to drift into basic research?
--Are undergraduates involved in research?
--How much time do faculty have for undergraduate research?

External Affairs

--Do you use your alumni college effectively?
--Do civil service employees and non-tenured staff understand the interdisciplinary nature of environmental problems; if not, can you realistically expect interdepartmental cooperation?
--If you have a cooperative extension program, 1) is it used to bring problems in to the University, as well as to disseminate information? and 2) how is it tied in to the "advisory and information" function of your environmental studies program?

Other

--What kind of an advising system have you devised to help students through a broad-based, interdisciplinary program such as environmental studies? How do faculty who act as advisors find out about programs? Do advisors have sufficient time to handle the increasing flexibility entailed in environmental studies programs?

--Do you use joint appointments? Are they jointly funded? How is promotion evaluted? Are they a real communications link?
--The professional schools--Law, Medicine, Planning, etc.--have a great deal to contribute to a problem-oriented program such as environmental studies, but 1) should they teach "service courses" to undergraduates, and 2) how are they tied into interdisciplinary research programs?
--Is Environmental Studies going to be done within the basic departments or will "hybrid" people be called for?
--Can a person get an advanced degree for participating in a team-research project?
--Where does an environmentalist get a job?

Faculty Quotations

"Don't neglect the possibilities of restructuring." --Professor of Pharmacy

"Students are here for their own education--not to support the departments."
--Professor of Planning

"At the present time, the universities are only responding to outside pressure--they should take the initiative themselves."
--Vice President

"Compartmentalization occurs because demands on time are too stringent to allow casual communication or intellectual browsing."
--Professor of Engineering

"It's hell to walk all the way over to Social Science in the middle of the winter." --Professor of Engineering

"Anything to break down compartmentalization is needed."
--Professor of Engineering

"There are dangers in getting undergrads into 'relevant' research.
1. It may make specialists out of them.
2. They may not be able to adapt to changing problems.
3. What happens to the liberal education?"
--Professor of Economics

"The peer system contributes to specialization--we need mission-oriented subcultures." --Professor of Engineering

"What is the nature of Environmental Studies--basic or problem solving?"
"We have Ag Engineering and Ag Economics--how about Ag Politics and Ag Philosophy?" --Professor of Horticulture

"We have many courses but few foci." --Dean of Science & Mathematics

"Institutes and Centers tend to be effective as long as the people who set them up are around." --Dean of Science & Mathematics

"I would emphasize the importance of 'Historical Accident' in setting up academic disciplines." --Dean of Arts

"Water Resources should be offered as a specialization within each discipline rather than as a combined discipline with specialties within it." --Dean of Engineering

"How about coordinating environmental specialties within each discipline?" --Dean of Engineering

"Environmental Studies should direct only interdisciplinary work." --Dean of Engineering

"If you're going to solve environmental problems, you've got to go underground." --Professor of Geology

"You must get out of the old departments--you cannot make changes within the old chain of command." --Professor of Biology

"You need to understand the basic principles of biology--mineral cycling, population, energy flow--before you can do anything." --Professor of Biology

"There is a general difficulty in relating a discipline to a problem--that is, the faculty--either they were not trained in problems or they forgot." --Center Director

"Environmental problems provide a good handle with which to shake the University." --Center Director

"It all boils down to the faculty-to-student ratio--you can't have decent education with the present ratios." --Center Director

"The University is the best place now for the development of long-range ideas." --Professor of Engineering

"Freshmen come to the University with a structured attitude: 'Tell me what I need to do for a grade.'" --Professor of Engineering

"When setting up a committee to study the problem, choose enthusiastic people rather than trying to get an even distribution." --Dean of Science & Mathematics

"Will we take a new route or use the environmental label as a cover for the same old thing?" --Dean of Humanities

"We need a fixed lifetime on all centers and institutes."
--Dean of Engineering

"It is the role of the Engineering School to turn out engineers, but they can be sensitized:

1. Through courses in ecology
2. Through setting parameters in terms of social concerns
3. Through sensitizing faculty."

--Professor of Engineering

Student Quotations

"Team teaching would be fine if there were a team rather than a collection of faculty."

"Project-oriented courses suffer from three major ills: ill-defined projects, lack of leadership, and too little time."

"Where can a person go for a generalist background? Courses and curriculums both suffer from the common ill of being no more than a "laundry list" of topics with little to tie them together."

"There is no consideration of an end goal in the design of the environment courses we see popping up. A course is put together and when it's over and doesn't lead anywhere, then we decide, Oh well, that was for awareness."

"The Process of education is finally getting some attention."

"The Administration is much more favorable to interdisciplinary work than the faculty."

"There's a lot of talk about the need for an environmental curriculum -- but when the showdown came at this place, the money wasn't appropriated."

"Many courses pose "Awareness of Environmental Problems" as their goal, but no one seems to ask if this is a viable goal. Will awareness make a difference in ultimate social reality?"

"The job of developing curriculum has fallen to the students and young faculty, because the established people can't work across disciplinary lines."

"Many students, who have just completed their first year of work, say "Wow" I learned more in the first 6 months on my own than I did in a whole four years of college! I do not think they learned more - but rather that the work experience forced them to integrate the scattered knowledge of the classroom. We need "real-life" integrating experiences scattered through the 4 years rather than only at the end - this is the value of action programs."

"There is a great deal of student apathy here, in fact this is the main characteristic of student attitude toward environmental problems."

"If positive pressure were exercised to bring students in and seek their opinions - rather than just their benediction - student input might begin. But just opening the doors is not enough - students are too cynical and many of the good ones, whose opinion could really help will not come."

"After seven years of research into the problem of animal waste disposal, we've finally come to the conclusion that it's better to spread it around than to pile it up."

APPENDIX E
SOME LAND HOLDINGS OF THE CIC UNIVERSITIES

During the course of the survey, it occurred to us that the land holdings of the various universities represent a unique, and not fully utilized, resource of the CIC because of the diversity of environmental conditions represented. We list here those off-campus land holdings which have some buildings and staff on the site. The list is incomplete because not all universities replied to our several requests for information, and some were taken from catalogues.

Indiana University

Kent Biological Farm	(Bloomington)	94 acres
Angel Archaelogical Mounds	(Evansville)	471 acres
Lake Monroe Biological Field Station		245 acres
Bradford Woods	(Martinsville)	
Crooked Lake Biological Research Laboratory	(Columbia City)	
Lilly-Dickey Farm	(Nashville)	

University of Iowa

Lake Okoboji Biological Station	(Northwest Iowa)	96 acres
Muscatine Wood Forest and Botanical Preserve	(Muscatine)	37 acres
Oakdale	(Iowa City)	563 acres

The University of Michigan

Base Lake Farms	(Dexter)	206 acres
Biological Station	(Pelliston)	8,843 acres
Camp Filibert Roth	(Iron Co. U.P.)	120 acres
Dearborn Campus		202 acres
Flint Area		0.5 acres
Fresh Air Camp	(Dexter)	170 acres
E. S. George Reserve	(Livingston Co.)	1,335 acres
Gordon Hall	(Dexter)	70 acres
Keweenaw Rocket Site	(Keweenaw Peninsula)	203 acres
McMath-Hulbert Observatory	(Dexter)	9 acres
Missaukee County		440 acres
Mud Lake	(Dexter)	257 acres
Observatory & Radio Station	(Dexter)	147 acres

The University of Michigan (Continued)		
Osborne Preserve - Islands	(Chippewa Co. U.P.)	3,150 acres
"Ringwood" Forest Reserve		160 acres
Speech Camp	(Traverse Bay)	26 acres
Stinchfield Woods	(Dexter)	664 acres
Willow Run Airport	(Ypsilanti)	2,139 acres
Michigan State University		
Upper Peninsula Experiment Station	(Chatham)	
Dunbar Forest Experiment Station	(Sault Ste. Marie)	
Lake City Experiment Station	(Lake City)	
Graham Horticultural Experiment Station	(Grand Rapids)	
Muck Experimental Farm	(Laingsburg)	
South Haven Experimental Farm	(South Haven)	
W. K. Kellogg Biological Station	(Augusta)	
Fred Russ Forest	(Cassopolis)	
Ferden Farm	(Chesaning)	
Montcalm Experimental Farm	(Entrican)	
Sodus Horticultural Experiment Station	(Sodus)	
Trevor Nichols Experimental Farm	(Fennville)	
University of Minnesota		
Lake Itasca Forestry and Biological Station	(Headwaters of the Mississippi River)	
Northwestern University		
Lake Michigan Landfill Harbor	(Evanston)	84 acres
Ohio State University		
Barneby Agricultural Center	(Lancaster)	980 acres
Franz-Theodore Stone Biological Laboratory	(South Bass Island, Lake Erie)	

Purdue University

Pinney Farm	(Laporte Co.)	487 acres
Sand Field	(Marshall Co.)	6 acres
Miller Farm	(Frang Co.)	700 acres
Herbert Davis Farm	(Randolph Co.)	111 acres
Lynnwood Farm	(Hamilton Co.)	623 acres
Nelson Stokes Forestry Tract	(Putnam Co.)	161 acres
Feldun Farm	(Lawrence Co.)	98 acres
SW Indiana Horticultural Farm	(Gibson Co.)	80 acres
So. Indiana Agricultural Center	(Dubois Co.)	1,016 acres

University of Wisconsin

Experimental Farms

Charmany	(Dane Co.)	216 acres
Gugel	(Dane Co.)	10 acres
Mandt	(Dane Co.)	152 acres
Rieder	(Dane Co.)	119 acres
West Hill	(Dane Co.)	20 acres
Arlington	(Dane & Columbia)	2,024 acres
Ashland	(Bayfield Co.)	241 acres
Emmons Blaine	(Jefferson Co.)	545 acres
Hancock	(Waushara Co.)	293 acres
Lancaster	(Grant Co.)	533 acres
Marshfield	(Wood Co.)	171 acres
Peninsula	(Door Co.)	121 acres
Spooner	(Washburn Co.)	400 acres
Three Lakes	(Oneida Co.)	239 acres

Arboretum and Forest Tracts

Abraham's Woods	(Green Co.)	40 acres
Bruckert "Future" Arboretum	(Sauk Co.)	40 acres
Chiwaukee Prairie	(Kenosha Co.)	63 acres
Faville Prairie Preserve	(Jefferson Co.)	58 acres
Finnerud Forest	(Oneida Co.)	98 acres
Lodde's Mill Bluff	(Sauk Co.)	14 acres
Oliver "Shooting Star Hill" Prairie	(Green Co.)	4 acres
Raymond Prairie Hill	(Dane Co.)	6 acres
Upham Woods Youth Camp	(Juneau Co.)	319 acres
University of Wisconsin Arboretum	(Dane Co.)	1,245 acres

Arboretum and Forest Tracts (Continued)

University of Wisconsin Centennial Forest	(Eau Claire Co.)	84 acres
University of Wisconsin-Green Bay Arboretum	(Door Co.)	250 acres
University of Wisconsin-Milwaukee Benedict Prairie	(Kenosha Co.)	6 acres
University of Wisconsin-Milwaukee Cedarburg Arboretum	(Ozaukee Co.)	180 acres
University of Wisconsin-Parkside Arboretum	(Kenosha Co.)	237 acres
University of Wisconsin-Parkside "Ranger Mac Fen"	(Racine Co.)	33 acres
University of Wisconsin-Waukesha Center & UW-Milwaukee Thomas Farm	(Waukesha Co.)	92 acres

Laboratory Tracts

Kemp Biological Station	(Oneida Co.)	130 acres
Pine Bluff Washburn Observatory and Woods	(Dane Co.)	53 acres
Trout Lake Biological Station	(Vilas Co.)	58 acres

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3. "Directory of Organizations Concerned with Environmental Research," compiled by W. A. Mordy and P. A. Sholtup, State University College, Fredonia, New York, January, 1970.

4. "Environmental Education 1970," A Scientist's Institute for Public Information Workbook, compiled by Everett M. Hofner, John M. Fowler and Curtis A. Williams for the SIPI, New York, N. Y., 1970.

5. "A Survey of Environmental Science Organizations in the U. S. A.," edited by Dr. J. Y. Young, Environmental Sciences Institute, San Jose, California; and Raymond R. Bolter, Ecology Center, Berkeley, California. Published by the Ecology Center Press, 1360 Howard St., San Francisco, California.

6. "Great Lakes Institutions: A Survey of Institutions Concerned with the Water and Related Resources in the Great Lakes Basin," Great Lakes Basin Commission, et al., June, 1969.

7. "A Proposed University Program for Environmental Quality in Ohio," Ohio Board of Regents Inter-University Committee on Environmental Quality, November, 1970, Columbus, Ohio.